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Mariners Weather Log

National Oceanic and Atmospheric Administration • National Environmental Satellite, Data, and Information Service • National Oceanographic Data Center

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Mariners Weather Log

Editor: Elwyn E. Wilson

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Front Cover: The BALTIC TRADER, PAUL THAYER and an unknown ship in the background caught in the ice jam in the St. Clair River in late April 1984. U.S. Coast Guard Photo.

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The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through April 1, 1986.

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Mariners Weather Log

GREAT LAKES NAVIGATION SEASON, 1984

Elwyn E. Wilson
National Oceanographic Data Center
Washington, D.C.

The 25th anniversary season for the St. Lawrence Seaway opened on April 2, 1984. The first ship upbound through the St. Lambert lock was the SELKIRK SETTLER followed by the FEDERAL THAMES. The first downbound transit was made by the RALPH MISENER through the Iroquis lock on April 1.

The Welland Canal was opened on March 28 by the RALPH MISENER which wintered at the south end of the Canal. The first passage from Lake Erie was made by the MANITOULIN also on the 28th. The first upbound was the same day by the JEAN PARISIEN. Overseas traffic through the Welland began on the 7th with the BANJI LUKA the second saltie up the Seaway and through the Soo on the 9th (fig. 1).

Figure 1.-- The BANTA LUKA on the St. Clair River on April 8, 1984. Photo by Albert G. Ballert, Great Lakes Commission.

Figure 2.-- A U.S. Coast Guard photo of the CASON J. CALLOWAY from the stern of the MACKINAW.

The Soo Locks were scheduled to open April 1 but the date was advanced to March 26. The first upbound was the CASON J. CALLAWAY (fig. 2) preceded by the icebreaker MACKINAW. The first downbound from Lake Superior was the SIMCOE on the 29th. This year marked the start of the 130th year of operation for the Soo Canal which opened in June 1855.

A few lakers operated throughout the winter with more active on the lakes during March. Several had to have icebreaker assistance.

The Seaway closed a record-breaking 275-day season on January 2, 1985 when the ALGOWEST cleared upbound. The previous latest closing was December 26, 1977. The last saltie, the ZIYA S. cleared on December 30. The Seaway stayed open because of a massive backlog of ships both upbound and downbound caused by the malfunctioning bridge at Valleyfield, Quebec. It took 18 days to repair the bridge and 160 vessels were lined up to enter or leave the system.

The last saltie through the Welland was also the ZIYA S. The last laker up was the CARTERCLIFFE HALL on January 1, 1985 and the last downbound was the SEAWAY TRADER on December 29.

At the Soo the last lakers passed through on New Years Day, the LAKE MANITOBA downbound and the LAKE WABUSH upbound.

As an item of interest the following table shows the flag of registry, number of vessels, and the total trips of salt water vessels into the Great Lakes during 1984. Vessels from 39 countries entered the Lakes through the Eisenhower Lock. A total of 703 vessels passed through the Eisenhower Lock.

Belgium (6-24)	Liberia (45-93)
British (7-15)	Morocco (1-1)
Brazil (2-4)	Mauritus (1-3)
Canada (5-5)	Netherland Antilles (2-4)
Cayman Islands (3-5)	Norway (7-20)
Cuba (3-10)	Panama (80-105)
Cyprus (10-10)	Philippines (10-17)
Czechoslovakia (2-2)	Pakistan (2-3)
Denmark (4-4)	Poland (7-10)
Dutch (8-9)	Peru (2-4)
Finland (8-12)	Russia (15-15)
France (6-12)	South Africa (1-2)
German (3-4)	Singapore (15-28)
Greek (99-123)	South Korea (2-2)
Hong Kong (9-15)	Spain (16-24)
Iceland (1-4)	Switzerland (2-2)
India (14-15)	Sweden (6-11)
Italy (6-9)	Turkey (18-23)
Japan (5-7)	United States (3-7)
	Yugoslavia (20-33)

The NOAA Buoys were deployed in the spring and retrieved in the late fall.

Precipitation over the Great Lakes basin averaged 32.15 in which was 1 percent above the long-term average (table 1). Precipitation has been above average for 9 of the last 10 yr. with

only 1976 below average. The Lake Huron basin was 16 percent above average. Lake Erie basin was also above average. The other three basins were below average with Lake Ontario a minus 11 percent.

Table 1.--Annual precipitation data (in)

Precip in inches	Great Lakes Basin	Lake Superior	Lake Michigan	Lake Huron	Lake Erie	Lake Ontario
1900-84 avg.	31.85	29.91	31.39	31.69	34.24	34.57
1984	32.15	29.09	29.74	36.65	35.26	30.91

NATIONAL WEATHER SERVICE

The National Weather Service conducted their Marine Weather Program as in other years. The products and services included weather warnings, forecasts, advisories and statements; ice forecasts and outlooks; low water statements, and lake shore warnings and statements. The total number of gale and storm warnings were only 141, down from previous years (table 2). Only 18 storm warnings were issued. More warnings were issued for Lake Michigan than any other lake.

Table 2.--1984 Great Lakes gale and storm warnings

	Super G/S	Mich G/S	Huron G/S	St. Clair G/S	Erie G/S	Ontario G/S
Jan	2 1	2 1	2 0		0 0	0 0
Feb	3 0	4 1	2 1	1	1 1	0 0
Mar	3 0	4 0	3 0	1	3 0	0 0
Apr	5 1	5 2	-		2 1	1 0
May	1 0	1 0	1 0		2 0	0 0
Jun	-	-	-		0 0	0 0
Jul	-	-	-		0 0	0 0
Aug	-	-	-		0 0	0 0
Sep	2 0	1 0	2 0		3 0	0 0
Oct	6 1	5 5	4 0		1 0	1 0
Nov	3 0	3 0	5 0	1	2 0	2 0
Dec	7 2	7 1	6 0		7 0	6 0
Totals	32 5	32 10	25 1	3 0	21 2	10 0

Total gale and storm warnings issued past 10 yr. 1984 - 141

1983-177	1980-173	1977-262
1982-194	1979-227	1976-399
1981-136	1978-241	1975-276

OBSERVATION PROGRAM

The National Climatic Data Center received 10,566 observations from the 32 lakers participating in the program. Only synoptic observations submitted on the Great Lakes Ships' Weather Observations, NOAA Form 72-1A(GL) were included in this total (table 3). This was quite an improvement over 1983 by 6 fewer ships. Lake Superior, as always, had the most traffic and observations. The highest monthly total was during June.

Table 3.--Total count of ship observations, 1984

LAKE	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTALS
ONTARIO						1							1
ERIE				92	84	63	51	61	89	99	71	76	585
HURON			7	120	394	375	751	372	379	227	396	137	2803
MICHIGAN				179	336	376	747	385	393	379	376	184	2927
SUPERIOR			0	193	576	635	613	670	546	532	473	156	4330
TOTALS			7	584	1372	1849	1612	1418	1377	1297	1266	623	10566
TOTAL NUMBER OF SHIPS REPORTING			32										

Table 4 shows a breakdown of the numbers of observations for selected severe weather types. Low visibility as usual lead the bad weather reports with winds greater than 30 kn second. June had the highest numbers of low visibility observations --274-- and the highest percentage of observations -- 19 percent.

Table 4.--Summary of selected severe weather data.

SELECTION CRITERIA	WINDS >30 KNTS	VISIBILITY CODE < 96	SEVERE WX CODE=13,17-19,24, 27,29,57 OR > 86	SEA HEIGHTS CODE=8-12 (12 TO 20 FT)	SEA HEIGHTS CODE >12 (>20 FT)
TOTAL # OF OBS	385	974	119	40	10

Table 5.--High wind speed distribution (kn)

LAKE	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTALS
ONTARIO													
34-40													
41-47													
48-55													
56-63													
ERIE													
34-40				1					1		1	1	4
41-47													
48-55													
56-63													
HURON													
34-40					5	1		1	6	7	12	12	44
41-47				2	1						2	4	9
48-55				1								1	1
56-63												1	1
MICHIGAN													
34-40				1	1				5	7	25	5	44
41-47				1	2					3	1	1	8
48-55				1								3	4
56-63													
SUPERIOR													
34-40				4	5	6			5	19	30	12	85
41-47					1	1				7	2	3	14
48-55													
56-63				1									1
TOTALS													
34-40				12	13	7		1	14	33	68	30	183
41-47				3	4	1				10	5	8	31
48-55				2								3	5
56-63				1								1	2

Table 6.--Waves of 20 ft. or more

Lake	Ship	Date	Height (ft)
Erie	J.A.W. IGLEHART	April 14	20
Huron	J.A.W. IGLEHART	April 15	20
		June 9	20
Michigan	SPARROWS POINT	Sept. 8	20
Superior	COLUMBIA STAR	Nov. 01	21

Tables 5,6, and 7 shows the data for high winds and waves. Lakes Huron and Superior tied for the highest sustained wind measured of 56 kn in December and April respectively. Overall Lake Superior had more high winds. She had 100 reports of winds over 33kn (gale force or greater). The other four Lakes together had only 121 reports of gale force or greater. The highest reported waves were 30 ft on Lake Huron in May but the 6-kn wind speed would not support such a height. The next highest waves were 21 ft with 40-kn winds on Lake Superior in November.

This article and the tables are based only on those weather observations logged on the Ship's Weather Observation Form 72-1A(GL) and forwarded to the National Climatic Data Center, Asheville, NC.

NOTABLE WEATHER HAPPENINGS

The three upper lakes, Huron, Michigan, and Superior were very close to being even as far as stormy weather was concerned. Superior had more observations of high winds but also had more total observations. When the number of high winds are compared with the number of observations on each of the three lakes the percentages are within three tenths of one percent. The reports of severe weather types were also very close. There were more high wave reports from Lake Michigan. November was probably the stormiest month. There were no wind reports greater than 40 kn on Lake Erie and only one thunderstorm report. Lake Ontario could not be evaluated as only one observation was received from that lake.

This data and the number of observations must be evaluated in terms of the season and the

number of boats operating. The most severe storms generally occur in the late Fall and Winter months when few boats are operating.

The following paragraphs describe some of the more significant weather as indicated by the weather charts and observations. Canadian ships and ships that do forward their observations to the National Climatic Data Center have have experienced heavier weather in the same or other storms. Tracks of the more severe storms are shown in figure 3.

Table 7.--Highest 1-min. wind (kn) reported on the Great Lakes by U.S. Anemometer-equipped vessels.

YEAR	LAKE ERIE		LAKE HURON		LAKE MICHIGAN		LAKE SUPERIOR		LAKE ONTARIO	
1941	W	42	WSW	50	NW	43	NNW	54	--	--
1942	WSW	52	WSW	56	WNW	48	S	62	--	--
1943	WSW	57	WNW	43	SSW	50	WSW	52	--	--
1944	NE	38	NW	37	WSW	48	NNE	42	--	--
1945	WNW	52	SSW	54	WNW	49	NW	52	--	--
1946	SW	50	W	46	S	44	NW	47	--	--
1947	NW	51	SSE	43	ENE	39	WSW	43	--	--
1948	WSW	40	NNW	51	NW	45	WSW	48	--	--
1949	W	52	NNE	50	NNW	43	W	52	--	--
1950	SW	70	NW	48	NW	49	NW	81[1]	--	--
1951	WSW	37	WSW	50	SW	49	WSW	54	--	--
1952	SW	46	SW	57	SSW	44	WSW	45	--	--
1953	WSW	49	NW	45	NNW	46	ENE	50	--	--
1954	W	45	NW	45	E	48	W	43	--	--
1955	W	52	SW	57	WSW	58[1]	NW	48	--	--
1956	WSW	46	W	43	SSW	46	N	50	--	--
1957	WSW	72	SW	54	WSW	49	W	47	--	--
1958	SW	61	SW	43	SW	52	SSW	54	--	--
1959	W	42	NE	50	E	48	W	54	--	--
1960	NE	55	WSW	49	NW	55	N	54	--	--
1961	W	50	NW	47	NW	48	N	57	--	--
1962	NW	52	WNW	63	NW	48	NNW	60	--	--
1963	NNW	74	NW	60	N	52	NNW	52	E	35
1964	WSW	68	W	72	NW	54	WSW	62	WNW	50[1]
1965	WSW	60	WNW	95[1]	ESE	52	SW	70	W	40
1966	ENE	49	NE	60	NW	57	NNE	61	W	39
1967	WSW	43	W	58	ENE	55	NE	53	W	32
1968	W	63	NNW	44	WSW	46	NNE	55	SW	31
1969	WSW	44	NNW	46	NW	50	SSW	50	--	--
1970	W	52	W	62	NW	52	W	63	--	--
1971	SW	50	W	53	N	50	SW	56	--	--
1972	W	45	NW	56	N	54	NNE	60	--	--
1973	SW	45	ENE	44	NE	56	NE	50	--	--
1974	ENE	48	SW	47	SW	42	ESE	46	W	38
1975	NE	40	WSW	60	SW	54	W	50	NW	32
1976	W	48	S	56	NNW	55	NE	54	W	34
1977	WSW	44	SE	48	ESE	44	SW	56	NW	26
1978	SSW	80[1]	ENE	50	E	55	S	56	WNW	33
1979	W	42	W	44	WNW	55	NNE	52	W	26
1980	NNE	44	N	50	NNE	52	S	56	--	--
1981	W	55	NW	50	NW	50	ENE	56	SSE	37
1982	W	43	W	53	SW	42	N	60	--	--
1983	SW	45	NE	49	W	56	NW	48	--	--
1984	S	40	WSW	56	W	50	N	56	--	--

[1]Highest for each lake

JANUARY-FEBRUARY-MARCH

The year started out with warmer than normal temperatures on January 3, new record high temperatures for the day were set at Duluth, MN and Marquette, MI. The month turned out to be colder than normal overall from minus 2°F over Lake Superior to minus 7°F over Lake Huron. An expecially cold period was from the 19th to the 22d.

February was a turn about with warmer than normal temperatures of plus 7°F over the south part of the basin to plus 11°F over the north. Some record high temperatures into the 60's occurred on the 12th and 13th, also on the 22d and 23d. Sault Ste Marie had an 8 day stretch of "warm" weather from the 11th to 18th where the average temperature was 32°F or higher. The longest period since records were kept. The 26th to 29th brough heavy snow and high winds to the southern part of the basin.

Figure 3.-- Tracks of storms with winds over 50 kn and waves over 15 ft.

March brought another reversal with colder than normal temperatures, minus 8°F over Lake Erie to minus 3°F northern Michigan to minus 6°F over Lake Superior. The 8th and 9th brought heavy snow and record lows to the lower Lakes. There were high winds over Lake Michigan on the 15th and heavy snow over the south shore of Lake Superior on the 20th and 21st. Some early shipping on the Lakes had problems with ice. There were 8 weather reports, 2 on Lake Huron and 6 on Lake Superior.

APRIL

The season officially opened with good weather prevailing over the Great Lakes and St. Lawrence Seaway. The Basin was generally under the influence of high pressure the first third of the month except for a LOW that moved south and east of the Lakes the end of the first week. This weather situation brought prevailing northeasterly winds to the Lake Huron and St. Clair area. These northeast winds blew ice into the south end of Lake Huron and the St. Clair River. An ice jam up to 9-ft thick blocked the St. Clair River. The decrease in river flow lowered the level of Lake St. Clair 2.5 ft. (fig. 4). During most of the month ships had to be escorted by icebreakers and the river was closed several times (fig. 5). On April 23

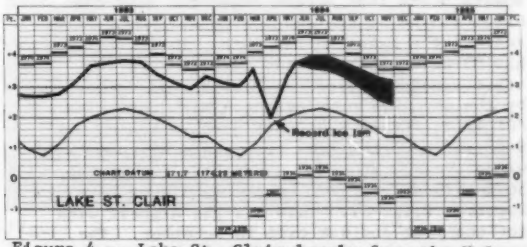

Figure 4.-- Lake St. Clair levels from the U.S. Army Corps of Engineers Monthly Bulletin.

Figure 5.-- The USCGC MACKINAW (upper left) and Canada's CCGS DES GROSSEILLERS pass on the St. Clair River as they assist the many stranded vessels. U.S. Coast Guard Photo.

there were 82 vessels waiting to enter the river, 64 upbound and 18 downbound. Nine icebreakers tried to keep a passage clear. Two or three icebreakers would convoy five or six ships through the ice. Several ships went aground or were damaged by the ice (fig. 6 and 7). By the 30th most of the ice was gone and the traffic back to normal. The article Ice Jam Halts Lakers was in the Fall 1984 issue.

Figure 6.-- The JOHN B. AIRD nearing the head of the St. Clair River on April 26, several days before the ice jam broke up. Photo by Albert G. Ballert, Great Lakes Commission.

There were three significant storms across the Great Lakes during April, all the last half of the month. The first of these was a slow moving storm that became organized over the Great Plains on the 12th. The southerly flow reached the Lakes on the 13th. The BENSON FORD had 33-kn northeast winds on Lake Superior. The storm meandered over the Mississippi Valley and by the 16th was over southern Michigan. The PHILIP R. CLARKE had 36-kn north winds on Lake Superior. On the 17th there were 10 reports of winds over 30 kn. The BURNS HARBOR reported 56-kn winds from 020° on the middle of Lake Superior (fig. 8). This was the highest wind for the year and was tied in December. The BENSON FORD measured 39-kn also on Lake

Figure 7.-- The BALTIC TRADER trying to move against the current and ice finds its bow out of the water. U.S. Coast Guard Photo.

Superior. The GEORGE A. STINSON found 37-kn winds on Lake Michigan. The storm dissipated on the 18th as a new LOW formed near New York.

This LOW came out of the southwest on the 22d. High pressure was moving southeastward over the Great Lakes. Easterly winds of 35 kn

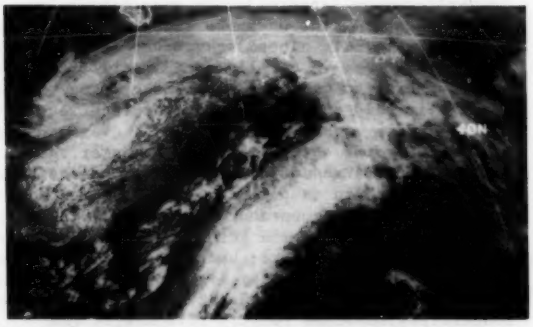

Figure 8.-- The storm that brought 56-kn winds to the BURNS HARBOR on Lake Superior on the 17th.

were blowing over Lakes Erie and Michigan. These were reported by the S.T. CRAPO and STEWART J. CORT on Michigan and H. LEE WHITE on Erie. Some ships on western Lake Erie and the Detroit River waiting to transit the ice in the St. Clair River dragged anchor.

The last storm moved northeastward out of Texas on the 29th. The circulation started effecting the lakes early on the 30th. At 1200 it was 980 mb near Green Bay, Wisconsin (fig. 9). There was heavy rain ahead of the storm and heavy snow behind it. Winds gusted up to 75 mi/hr. Winds at Chicago gusted up to 70 mi/hr and popped glass out of high-rise windows and broke trees. Twenty people were injured and 12 were killed. In Michigan over 200,000 customers were without power. Many other places had gusty winds (in mi/hr); Sault Ste. Marie - 58, Milwaukee - 64, Detroit - 63, Buffalo - 72 with prevailing 55, and Cleveland - 69. Two ships measured 50-kn winds, the JAMES R. BARKER on Lake Huron and the STEWART J. CORT On Lake Michigan. The H. LEE WHITE had 45-kn and 15-ft waves on Lake Michigan. There were still winds of 40-kn or more on Michigan and Huron on May 1. The PHILIP R. CLARKE measured 45-kn west winds on Lake Huron. The EDWIN H. GOTT had 39-kn west winds and 16-ft seas on Lake Superior. The storm was out of the area on May 2.

Between 4 and 5 p.m. on April 30 the high westerly winds produced a 9-ft storm surge on Lake Erie between Toledo and Buffalo. The fishing vessel STANLEY CLIPPER sank in Lake Erie.

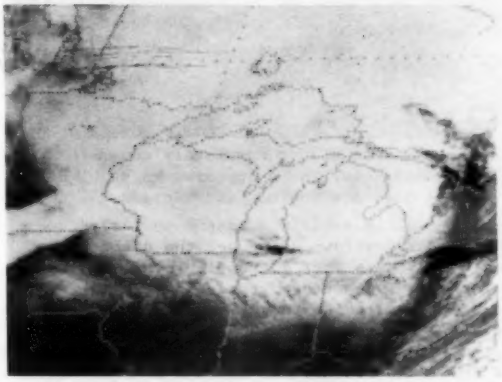

Figure 9.-- This is how the storm looked at noon on the 17th. Its high winds caused a lot of damage and power outages plus a 9-ft surge on Lake Erie. NOAA.

MAY

This month was colder than normal over the Great Lakes Basin from 5°F over central Michigan to normal (0°) over western Lake Superior. The worst storm of the month was on the 1st continuing from April.

On the 7th a LOW organized over the Dakotas and moved eastward. At 1200 on the 8th it was 998 mb near Thunder Bay. All the high winds were reported on Lake Superior. The highest was 42-kn by the BENSON FORD. The LEWIS WILSON FOY had 40-kn northwest winds on the 9th.

The next organized storm also came out of the Dakotas. By 0000 on the 25th it was near Thunder Bay at 997mb. The highest wind in this storm was 38 kn out of the south with rain showers over Lake Michigan on the 25th by the LEWIS WILSON FOY. The J.L. Mauthe had 31-kn winds on Lake Superior on the 26th.

JUNE

This was a quiet month as far as well-organized cyclones with only one. Most of the ship observations of winds over 30-kn were associated with a cyclone on the 8th and 9th. June had more low visibility observations and the highest percentage of the lakes. There were also many thunderstorm type observations. The basin was generally one to two degrees above normal in temperature with a four degree area in southern Michigan and zero degrees over Lake Ontario.

Frontal waves were moving northward on a stationary north-south fron over the Plains States. On the 8th one of them developed rapidly and was 983 mb north of Duluth at 1200. At 1800 the JAMES R. BARKER near Duluth measured 42-kn west-southwest winds. This was the strongest for the month. Duluth measured 46 mi/hr. On the 9th the GEORGE A. STINSON in the same area measured 40-kn winds. There were some 32-kn winds on Lakes Huron and Michigan. The storm had raced to northern Quebec by 1200. There were reports 18-ft waves on Lake Michigan and 20-ft waves on Lake Huron by the J.A.W. IGLEHART and 18-ft waves by the PRESQUE ISLE on Lake Michigan.

During the month some of the weather stations on the shore had high winds and gusts (in mi/hr); Cleveland - 51, Milwaukee - 53, Green Bay - 46, and Buffalo - 43. All with thunderstorms.

JULY

This was a quiet month. Weak cyclones moved over the Basin but the stronger cyclones were to the north. There were three wind reports over 30-kn, one each by three ships. On the 7th the EDWIN H. GOTT on Lake Michigan and the COLUMBIA STAR on Lake Huron had 32-kn winds. The PRESQUE ISLE also had 32-kn winds on Lake Michigan on

Figure 10.-- Yachys leaving the St. Clair River for the annual Port Huron to Mackinac race. Photo by Albert G. Ballert, Great Lakes Commission.

the 9th with a thunderstorm. The BURNS HARBOR had 18-ft waves on Lake Michigan on the 14th, and the PRESQUE ISLE had 18-ft waves on Lake Superior on the 15th. There were 18 observations of thunderstorms, lightning, or squalls (fig. 10).

Sault Ste Marie had gusts up to 58 mi/hr. with thunder on the 14th. There was a frontal system moving over the Lakes. On the 9th and 10th MIlwaukee had 74 and 81 mi/hr gusts. On the 11th a 36-ft powerboat was sunk by high waves in Lake Ontario 2 mi north of Rochester. Record low temperatures were set in many places over the Basin on the 8th and at Chicago and Detroit on the 30th. The mean temperature was normal over the northern part of the Lakes to minus 2°F over the south.

AUGUST

The Basin was under the influence of anticyclonic southwesterly flow in the mean. Weak cyclones and fronts moved over the area periodically with attendant thunderstorms. The stronger cyclones passed north of the Basin. The mean temperature was 2° to 3°F above normal for the month.

The highest wind by a ship was 40-kn on Lake Huron on the 10th in a thunderstorm by the PRESQUE ISLE. The other reports were less than 34-kn on Lakes Michigan and Superior. There were 31 thunderstorm type severe weather reports. No waves over 12-ft were reported. There were four reports of 32- and 33-kn winds on the 30th and 31st as a front moved across the Basin by the BENSON FORD, J.L. MAUTHE, SPARROWS POINT, and H. LEE WHITE.

Heavy rains caused considerable flood damage to the Cleveland area on the 15th. On the 30th the winds reached 53 mi/hr at Erie, PA.

SEPTEMBER

The Great Lakes were under the influence of high pressure for a greater part of the month than low pressure which is normal. There were three significant cylcones that passed over or near the Basin. The mean temperature was normal over eastern lower Michigan and central Lake Erie. Northern Lake Superior was 3°F colder than normal and Lake Ontario 4°F colder. The highest wind was 40-kn over Lakes Huron and Erie and not associated with thunderstorms. The highest waves were 20-ft on Lake Michigan.

The first storm formed on the lee side of the Rocky Mountains over Alberta. At 1200 on September 7 it was still over Saskatchewan but the southerly flow already reached Lake Huron. The HERBERT C. JACKSON on Lake Michigan had 39-kn winds from the south. At 1800 the GEORGE A. SLOAN near Milwaukee measured 38-kn winds and 15-ft seas. At 1200 on the 8th the storm center was holding back near Winnipeg but the frontal system had moved out of the LOW and over the Great Lakes. The MYRON C. TAYLOR had 32-kn winds. At 1800 the SPARROWS POINT near Green Bay had 37-kn winds from 210° and 20-ft seas. The frontal system had stalled over the Lakes just west of Lake Michigan by 1200 on the 9th. The BENSON FORD near Buffalo had 40-kn south winds. The storm was falling apart.

The second storm came out of Montana and moved north of Lake Superior on the 13th. It produced minimal gale-force winds on Lakes Huron, Michigan and Superior. The EDGAR B. SPEER had 38-kn south winds with a thunderstorm. The WILLIAM A. ROESCH had 35-kn winds also with a thunderstorm. The storm was out of the area early on the 14th.

This third storm was a front wave over Iowa on the 24th. On the 25th the H. LEE WHITE had 34-kn northeast winds on Lake Superior. At 1200 the storm was centered over Sault Ste Marie. The storm kept increasing in strength and was near James Bay at 0000 on the 26th. Several ships reported winds over 30-kn. The JOHN G. MUNSON Measured 40-kn northwest winds on Lake Huron at 0600. There were no more winds over 30-kn reported after 0600.

OCTOBER

This was a relatively quiet month on the Great Lakes, especially the first half. The temperature averaged 3°F above normal for the month. There was widespread fog over the Lakes the second week of the month. Traffic was temporarily stopped on the Detroit River because of low visibilities the 15th to 19th (fig. 11).

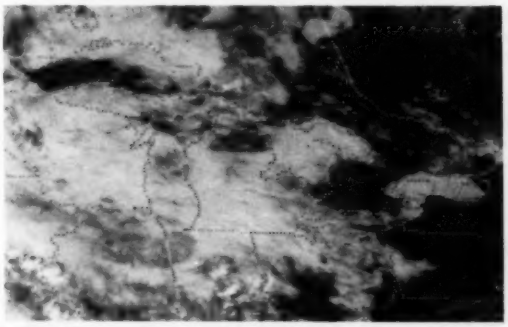

Figure 11.-- Fog almost completely cowers Lakes Huron and Erie. There appeares to be higher clouds over the fog on Lake Micigan. NOAA.

There was a 118 vehicle accident on Interstate 94 south of downtown Milwaukee the afternoon of the 14th. There were 43 people injured in the accidents. The weather station at Mitchell Field 5 mi to the south was reporting the visibility as less than 100 ft. The afternoon of the 16th in dense fog in the Pelee Passage the FRONTENAC brushed the WILLIAM A. LYDON which was towing three barges. One of the barges was badly damaged but did not sink. The mean pressure for the month was 2 mb above normal. The primary cyclones occurred the last half of the month. The highest wind was 45-kn and highest waves 16-ft.

A frontal wave raced northward west of the Lakes on the 15th and 16th. Another wave developed on the 16th and the center passed west of the Lakes but the southerly flow brought high winds to Lakes Michigan and Superior. The H. LEE WHITE had 42-kn winds from 200° on Superior. The highest wind on Michigan was 36-kn by the EDGAR B. SPEER. By the 18th the storm had combined with the first one.

This storm formed over Colorado early on the 18th and moved northeastward. There were more

high wind reports with this storm than any of the others this month. At 1200 on the 19th the center was 986 mb near St. Paul, MN. There were two reports of 45-kn winds, one on Lake Superior by the EDWARD B. GREENE, and the other by the GEORGE A. SLOAN on Lake Michigan. At 1200 on the 20th the storm was north of Duluth. The MYRON C. TALOR had 40-kn southwest winds on Lake Huron. The WOLVERINE had 39-kn west winds on Huron. The COLUMBIA STAR found the 16-ft waves on Lake Superior. On the 21st the storm was no longer of consequence.

Montana produced this storm on the 26th. There was already cyclonic circulation west of the Lakes so it quickly developed a large circulation. At 1200 on the 28th it was 974 mb over James Bay. There were two 45-kn wind reports on Lake Superior, one by J.A.W. IGLEHART and the other by the EDWIN H. GOTT. The EDGAR B. SPEER had 44-kn winds. The COLUMBIA STAR also on Lake Superior had 15-ft seas. The BURNS HARBOR had 34-kn on Lake Michigan and the JOHN G. MUNSON had 38-kn on Lake Huron. By the 29th high pressure was over the Lakes.

NOVEMBER

As usual November was a very stormy month and probably the worst of the year on the Lakes. It is a transition month from Fall to Winter type weather. In general the weather was warmer than normal except over Lake Huron and Cntario. The highest waves of the year - 21-ft - occurred on Lake Superior on November 1. The highest reported wind of 45-kn also occurred that day on the same Lake, but not at the same time or by the same ship (fig. 12).

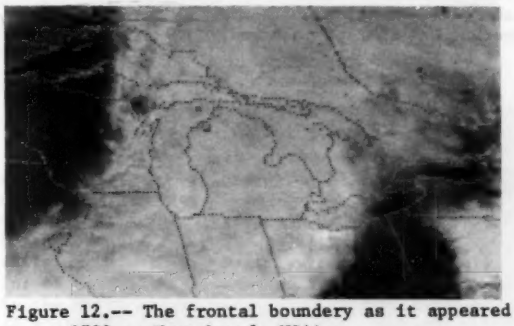

Figure 12.-- The frontal boundery as it appeared at 1730 on November 1. NOAA.

The first storm of the month started gathering strength the last of October. As the month started the storm was 998 mb centered over Lake Winnipeg. At this time the EDWIN H. GOTT, north of Whitefish Bay measured 45-kn southeast winds. At 1200 the center of the storm was approaching Hudson Bay. The cold front was over Lakes Superior and Michigan. At 1800 the COLUMBIA STAR was south of Isle Royale with 40-kn west winds and 21-ft seas. On the 2d the H. LEE WHITE On Lake Michigan had 40-kn west winds. The WILLIAM A. ROESCH on Lake Huron had 44-kn winds. The LOW had moved into northern Quebec and the cold front was on the U.S. East Coast.

This storm organized over Kansas on the 9th. By the 10th its winds had reached the Lakes. The WILLIAM J. DELANCEY on western Lake Superior had 37-kn northeast winds. On the 11th the storm was south of Chicago. The EDWIN H. GOTT On Lake Michigan had 40-kn winds. The J.A.W. IGLEHART on Lake Huron had 32-kn winds. The storm was near Buffalo on the 12th. The BENSON FORD on Lake Huron measured 43-kn north winds with heavy rain and snow. The IGLEHART near Cleveland had 33-kn northwest winds. By the 13d the storm was out of the area.

Montana produced this storm on the 14th. There already was southerly circulation from high pressure over the midwest so it quickly became a large storm. The GEORGE A. SLOAN on Lake Michigan had 32-kn south winds. At 1200 on the 15th the LOW was 996 mb near International Falls. There were many gale-force winds this day. The EDGAR B. SPEER near Chicago had 40-kn west winds. At 1200 on the 16th the storm was centered north of Ottowa. The CASON J. CALLAWAY on Lake Michigan had 44-kn winds from 290°. Several ships had 13-ft seas and many had gale-force winds. On the 17th the LOW was over the Labrador Sea but the cyclonic circulation still reached the Great Lakes. The JAMES R. BARKER had 42-kn northwest winds with 13-ft waves on Lake Superior. Three other ships had 40-kn winds. The BENSON FORD measured 31- and 32-kn winds on Lake Superior early on the 18th. After that time the storm was no longer an influence.

The remainder of the month was quiet weatherwise and the Lakes were under the influence of high pressure except for the last few days.

The Seaway was closed on November 21 when the Larocque Bridge at Valleyfield, Quebec became stuck midway open. It was finally opened again on December 9. There were reportedly 99 vessels waiting to pass downbound and 61 upbound on December 9. the weather was favorable during the closed period and afterwards so all vessels were able to transit the system.

DECEMBER

Luckily for the ships awaiting repair of the Larocque Bridge over the St. Lawrence the temperature this month averaged above normal. At Buffalo the temperature averaged 6.8°F above normal. On the 16th and 17th many cities set new records above 60°F. The 28th and 29th brought another record warm spell again with temperatures in the 60° range.

The first significant storm came off the east side of the Rocky Mountains on the 2d. At 1200 on the 3d it was 1001 mb near Sault Ste Marie. The first high winds were reported at 0000 on the 3d. At 1800 the GEORGE A. STINSON reported 47-kn west winds with snow showers on Lake Huron. Sault Ste Marie had over 9 in of snow. At 1200 on the 4th the storm was centered east of the James Bay. There were several gale reports. The J.L. MAUTHE On Lake Michigan had 40-kn winds with a half inch of ice on the ship. The WOLVERINE on Lake Superior had 35-kn winds. On the 5th this storm had moved northeastward and a front was approaching Lake Superior.

This storm was a frontal passage with a weak frontal wave. The LOW was over northern Quebec

as the front approached on the 5th. At 1700 the CITY OF MIDLAND on Lake Michigan measure 32-kn southwest winds. The LEWIS WILSON FOY on Lake Superior found 33-kn winds and had 8cm (3.2 in) of ice on the hull. On the 6th the front stretched north-south across lower Michigan. The tight gradient was in the cold air west of the front. The J.L. MAUTHE On Lake Michigan measured 44-kn northwest winds in moderate snow. The H. LEE WHITE had 40-kn winds with snow in the past hour also on Lake Michigan. The GEORGE A. STINSON had 16-ft waves on Lake Superior. Early on the 7th the CASON J. CALLAWAY on Lake Huron had 38-kn winds. By 1200 another front was approaching the western Lakes.

This was the system that tied the highest wind of 56-kn for the year. A sharp ridge separated this storm and the one above on the 7th so within hours after that storm this one was bringing strong winds. The GEORGE A. STINSON was on Lake Superior at 0600 with 40-kn southwest winds. At 1200 she had 13-ft seas. The CITY OF MIDLAND sent a 2300 observation on Lake Michigan of 32-kn. On the 8th the front was over Lake Huron. At 0000 the WOLVERINE east of Alpena had 36-kn winds which increased to 56-kn by 0600 (fig. 13). The sky was overcast but no significant weather. By the 9th the storm was out of the area.

This was another case of a frontal passage with the LOW hundreds of miles to the north. The first strong winds of 34-kn were measured on Lakes Michigan and Superior on the 11th. The PAUL THAYER measured 34-kn south winds on Lake Superior. At 2300 the CITY OF MIDLAND on Lake Michigan measured 48-kn winds. At 1200 on the 12th the front paralleled Lake Michigan. The WOLVERINE had 35-kn southwest winds on Lake Huron. At 2300 the CITY of MIDLAND still had 48-kn winds with heavy drizzle. There were no more high winds by the 13th as high pressure moved into the area.

There was a very complicated weather pattern on the 15th over the central United States that extended into Canada. By 1200 on the 16th a LOW over Minnesota had partially consolidated the weather pattern. Milwaukee had 38 mi/hr with gusts to 51 mi/hr. The GEORGE A. STINSON on Lake Superior on 1800 had 32-kn south winds. On the 17th the H. LEE WHITE On Lake Michigan measured 48-kn southwest winds. The STINSON had 13-ft waves. By 1200 the LOW had raced to Labrador.

This LOW formed on the lee slopes of the Colorado Rockies on the 21st. It moved eastward then northeastward. At 2300 the ROGER M. KYES on Lake Huron had 44-kn southeast winds and 13-ft seas in heavy rain. At 0000 on the 22d the storm was 984 mb near Green Bay. The GEORGE A. STINSON now had 47-kn northwest winds on Lake Superior. Buffalo had 40 mi/hr winds with gusts to 52 mi/hr. The storm was out of the area on the 23d.

ACKNOWLEDGMENTS

Appreciation is extended to the masters and mates aboard the cooperating vessels for their valuable observations and contributions to the National Weather Service observing program. Useful information and photographs were contributed by Albert G. Ballert of the Great Lakes Commission and gleaned from the Great Lakes News Letter and Lake Log Chips. Of primary important were the wind, wave, visibility, and severe weather observations prepared by the National Climatic Data Center, Asheville, NC, upon which much of the specific weather information is based.

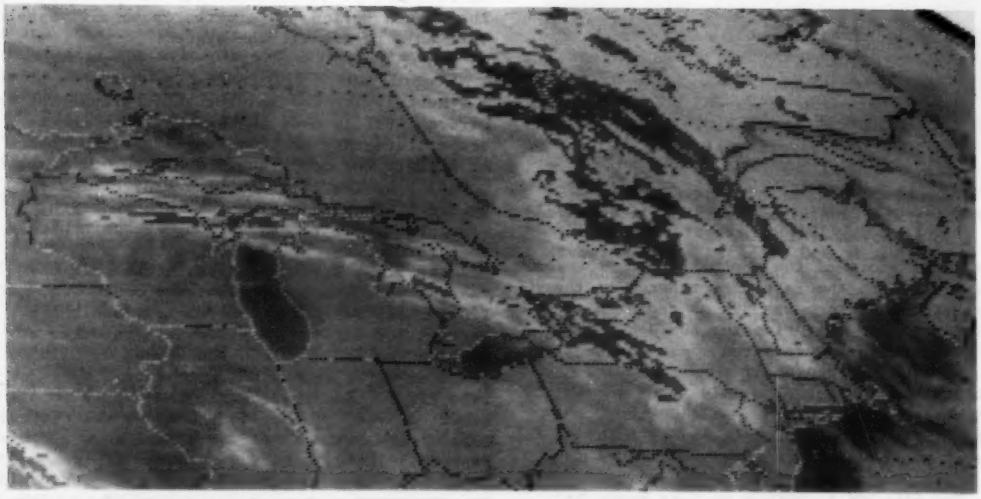

Figure 13.-- This infrared image was taken at 0600 On December 8 (midnight local). There were only a few clouds over Lake Huron at the time the 56-kn winds were recorded. NOAA.

UNDER THE BANGLADESH CYCLONE

Mariners Weather Log

DICK DeANGELIS
NATIONAL OCEANOGRAPHIC DATA CENTER
WASHINGTON, DC

The old adage "any port in a storm" as most sailors know "ain't necessarily so." This is especially true when the storm is an Indian Ocean tropical cyclone closing in on the northern Bay of Bengal. In these cases, 10-to-20-ft deep-water waves are preferable to a 10-to-20-ft storm tide at Chittagong or Cox's Bazar. And either is certainly preferable to living on one of the low lying islands in the delta region known as the Mouths of the Ganges. One night this past May residents of these numerous islands clung precariously to life as a 10-ft wall of water threatened to wash their world into the Bay of Bengal. For thousands it succeeded (fig. 14).

Figure 14.--This Sandwip Island woman survived but lost her family to the storm tide.

A tropical cyclone's power is measured in different ways. North Pacific typhoon Tip was noted for its record low 870-mb pressure along with 165-kn winds. Hurricane Camille in the North Atlantic generated a 72-ft extreme wave while a South Indian Ocean cyclone dumped 73.62 in. of rain on Reunion Island in a 24-hr period. In the North Indian Ocean an unfortunate measure of a storm's potency is often the number of lives it has claimed. By this measure the May 1984 cyclone was easily outdistanced by a November 1970 cyclone during which an estimated 300 thousand people died. However in this era when satellites and computers bring advance notice of impending disasters it is difficult to fathom a loss of nearly 6,000 lives in a single event. In these situations the solution lies beyond the grasp of the meteorologist.

Bangledesh, once the eastern province of Pakistan, is a country about the size of Wisconsin into which 100 million people are packed and about 7,000 are born each day. The country with its broad, flat landscape cut by the Ganges and Brahmaputra Rivers is susceptible to the ravages of tropical cyclones and monsoons. One third of the country floods each year as monsoon rains drive rivers over their banks. In the delta region thousands of islands are created and swept away from the tons of silt deposited by the two major river systems, which wind their way from the Himalayes. The silt shifts continuously,eroding some islands and creating new ones. These shifting islands, called "Chars", are crowded with farmers who come to plant and harvest rice and graze cattle on the rich soil. Unlike the Netherlands, Bangledesh has no dikes and evacuation is extremely difficult. After the disastrous 1970 storm, on the more stable islands, the government built hundreds of multistory concrete shelters, which are used year-round for offices and schools. In addition they put up sirens, distributed radios, built up embankments and planted mangrove forests on these islands. This then was the scene for the May cyclone.

In the North Indian Ocean (Bay of Bengal and Arabian Sea) an average of four or five tropical cyclones develop each year. May, October and November are the most likely months. Bay of Bengal storms have long been recognized as killers. As far back as 1737 a 40-ft "wall of water" was reported to have caused some 30 thousand deaths. (table 8). The November 1970 storm pushed a 20-ft storm surge into Bangledesh and across its offshore islands. This storm also generated 130-kn winds, which added to the devastation. Since 1960, Bangladesh has been the scene of nine such disasters with maximum storm tides ranging from 12 to 20 ft.

Table 8--Some of the more significant storm tide disasters in the Bay of Bengal

Date	Area affected	Maximum + storm tide (ft)	Maximum winds (kn)	Estimated deaths
1737 (Oct.)	South of Calcutta	40		300,000
1789 (Dec.)	Coringa			30,000
1864 (Oct.)	Calcutta	40		80,000
1876 (Oct.)	Bakarganj	30-40		215,000
1885 (Sept.)	False Point	22		10,000
1926 (May)	Burma			1,200
1941 (June)	Barisal			5,000
1942 (Oct.)	Bengal	16	80-85	40,000
1949 (Oct.)	Southeastern India			1,000
1960 (Oct.)	Bangladesh	12	60	6,000
1960 (Oct.)	Bangladesh	20	113	4,000
1961 (May)	Bangladesh	16	90	2,000
1963 (May)	Bangladesh		150	22,000
1964 (Dec.)	Ceylon	15-20		1,800
1965 (May)	Bangladesh	12	85	15,000
1965 (Dec.)	Bangladesh	12	130	15,300
1970 (Nov.)	Bangladesh	20	130	300,000
1971 (Oct.)	Orissa	20	100	10,000
1977 (Nov.)	Southeastern India	19	135	14,000
1979 (May)	Southeastern India	13	85	700
1984 (Nov.)	Southeastern India	10	85	430
1985 (May)	Bangladesh	15	60	11,000

+In most early storms, these are estimates

Two decades ago cyclones often appeared with very little warning. On May 28, 1963 the hot humid weather that had plagued Bangladesh was tempered by an evening breeze. Within a few hours the breeze became a gale, the gale a hurricane. Before it ended the coast reeled under a 15 hr pounding of winds and waves. At Chittagong winds reached 130-kn while the resort

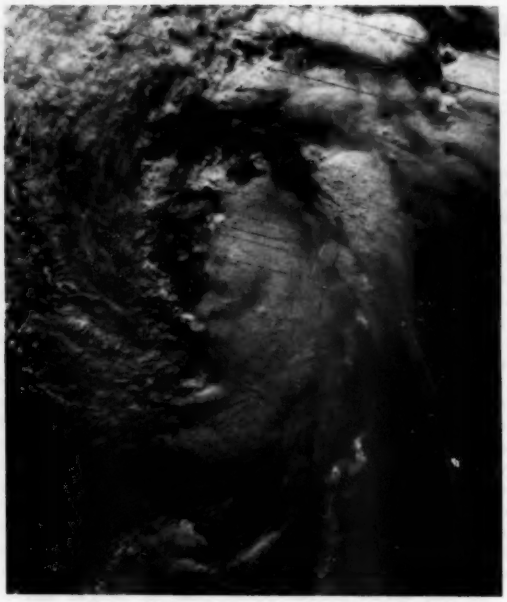

Figure 15.--A satellite image of the storm at 0108 on 24 May, 1985.

town of Cox's Bazar lay in ruins. Captain H. D. Smith, master of the INDIA MAIL, which was docked at Chittagong during the blow, wrote: "Perhaps the most outstanding and pathetic features of this storm were the insufficient warning for a storm of this magnitude and the phenomenal suddeness with which the storm came to vanish after a short but lethal duration."

With the increased use of satellites for detection, analysis and communication very few storms come as a surprise. However on this gloomy night in May modern technology was limited by centuries of tradition in the assistance it could provide the people of Bangledesh.

The tropical storm was first detected by the National Environmental Satellite, Data, and Information Service (NESDIS) Satellite Analysis Branch on the 22d. They, in turn, relayed the storms position and intensity to Bangladesh and continued to do so until after the storm moved ashore (fig. 15). They also provided information to the Agency for International Development (AID) and World Vision once the cyclone threatened Bangladesh.

Early indications of the storm came in the form of warnings to ships issued on the 22d at 0000 for gales and 12-to-18-ft seas between Sri Lanka and the Nicobar Islands. At this time there was no closed circulation but the disturbance was embedded in the early southwest monsoon, which was responsible for its intensity. The southwest flow over the North Indian Ocean was also helping to push water toward the Bangladesh coast. The first warning from the Joint Typhoon Warning Center was issued on the 23d at 1500 for tropical cyclone 01-B with a 1200 position of 17.3°N, 88.0°E. Maximum sustained winds were estimated at 40-kn. By

Figure 16.--Shelters such as this one on Urir Char helped save hundreds of lives. Survivors are lining up for relief supplies. WIDE WORLD Photo.

1200 on the 24th maximum winds were up to 55-kn with gusts to 70-kn and the center was within 150 mi of landfall. Winds increased to a peak of 60-kn within the next 8 hr. The full force of the storm was felt on the evening of the 24th as a storm surge estimated between 10 and 20-ft rolled across the low lying islands and swept ashore over southern Bangladesh.

The islands were completely inundated and people that couldn't make it to concrete shelters (fig. 16), held on to anything they could. They clung to roofs and the bamboo poles of their thatched huts. Some were able to survive by grabbing hold of the young trees of those mangrove forests planted a decade ago. However in many cases children, who make up about one-half of the island population, were unable to cling to anything and were swept away. On the lower islands, where dirt pathways crisscross rice fields, people live in small settlements of huts built on dirt mounds. Thousands of these mounds lay bare after the storm (fig. 17). Fortunately most of the rice crop had been harvested but tens of thousands of animal carcases littered the landscape.

The islands that suffered the most damage were Sandwip, Hatia, Mahesh Khali, Bhola, Urir Char, Char Clerk and Dhal Char. On Urir Char survivors (fig. 18) described the surge as a wave that "came like a big wall". An accurate assessment of damage and death will never be available in an area whose population shifts like the islands. It is known that thousands of lives were saved by the early warnings, the concrete shelters, and the rescue efforts of the Bangladesh Navy.

Further inland the torrential rains caused additional flooding in Bangladesh and Northeast India. Some 50 thousand people were affected when rivers breached their embankments. Tripura and Manipus States were the hardest hit.

While the estimate of 6,000 deaths seems needlessly tragic in this advance age, it is quite a bit lower than it would have been a decade or two ago.

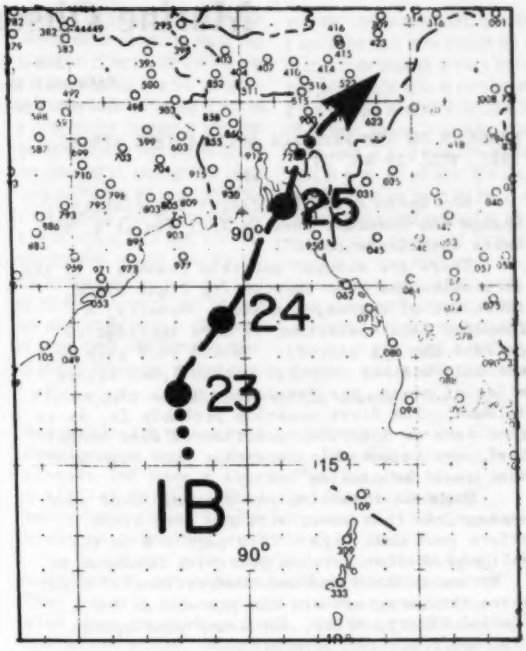

Figure 18.-- The track of tropical cyclone 01-B.

Figure 17.--A post storm prayer is offered as construction begins on a bamboo and metal shelter. In the background is one of the many barren mounds that a few days ago supported a hut. WIDE WORLD Photo.

Marine Observations Program

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Silver Spring, MD 20910

FEEDBACK ON THE FEEDBACK ARTICLE (MWL SPRING 1985, VOL. 29 NO. 2)

Why Doesn't the Forecaster Immediately Change the Forecast When We Tell Him It's "60 Knots With Gusts to 90"?

There are several possible reasons: If the forecaster has been forecasting light winds, there is, of course, a reason. Usually, a computer data field that is more inclined to present the big picture. Should your ship be the only weather reporter within 1,000 square miles of ocean, the forecaster has a real dilemma. The first question probably is, is it good data or a garbled position or wind speed? Next, why is one ship reporting such high wind? What could be causing it?

There is something you can do. Send your message, in this case, with the word STORM before your call sign. (See page 1-9 in the National Weather Service Observing Handbook No. 1, Marine Surface Weather Observations). Right above tht paragraph are the procedures for a SPecial REPort, SPREP, for lower wind speeds that don't fit the forecast.

Either of these reports may be sent at any time and will provide a special alert for the forecaster. It is important to send in at least an hourly abbreviated report (first 5 groups through Nddff plus the pressure, weather, and sea groups) until the forecast is changed. This does two things: first, it verifies your position and the weather conditions, and second, hourly reports certainly get attention, particularly with a STORM or SPREP lead.

The forecaster is hundreds, sometimes thousands, of miles away from your ship's position and it is only through your weather report that he knows what is happening at your position. Even if you see other ships in the area, don't depend upon them to send the weather report for you. If they are reporting, that's good; it immediately verifies the weather conditions. Two final points, only you know the weather at your position, fair weather or foul. The forecaster doesn't know whether he has hit or missed the forecast unless you send him a comment.

How Does the Comment or Feedback System Work?

You may make comments on the back of the "Ship's Weather Observations," NOAA Form 72-1A, or on a separate paper. The 72-1A is mailed in a preaddressed envelope (usually located with the forms on the bridge) and mailed to your ship's servicing Port Meteorological Officer (PMO). He will read your observations and comments and may take immediate action, send a copy to a forecaster, and send a copy to me. I get to see all comments primarily to be sure action, as appropriate, is taken. This also applies to communications comments. We have had some excellent feedback from radio officers and have often been successful in getting changes because of the feedback.

What Should My Ship be Getting by Mail?

All Voluntary Obserrving Ships (VOS) in our program should receive by mail the quarterly Mariners Weather Log and the appropriate Pilot Chart, Atlantic or Pacific or both. The weekly Notice to Mariners may come from your company or by direct mail. The two communications manuals Radio Stations Accepting Ships' Weather and Oceanographic Observations and World Wide Marine Weather Broadcasts are both being reprinted and the new manuals will be mailed to all the VOS ships in our program. All of the materials of your program are free to participating ships.

The servicing PMO's, whose address appears on your preaddressed envelopes, will look for checks on the "Supplies Needed" check list and mail or bring the materials you request aboard on the next port call.

How Do I Get A PMO to Visit My Ship?

As you say, page 1-14 in the National Weather Service Observing Handbook No. 1 is out of date. We now put an updated PMO List on the back cover of every issue of the Mariners Weather log. Have your agent or company contact the appropriate PMO with the dates you will be alongside in tht port or set a specific day and time, if you want to talk with him personally. Of course, remember that there is no PMO staff, and only one PMO in each of the specified ports.

Why Apparent Wind?

The next few comments came from Castine, Maine (can't read the signature).

Apparent wind direction and speed are observed from an anemometer or, as mentioned on pages 2-42 of National Weather Service Observing Handbook No. 1, from something on the ship, not directly from the ocean. The question probably refers to the "Apparent Wind" columns on the Ship's Weather Observations, NOAA Form 72-1A. These columns and the "Wet Bulb," "Remarks," etc. are shaded and are for local use as a notebook. If you estimate the wind from the look of the sea directly, you are estimating true wind, so the apparent wind column would not be used.

Why Cloud Height and How Accurate Should It Be?

The marine and land synoptic report forms are designed to be the same where possible. Cloud height is primarily used at airports on land, where they have instruments to measure cloud height. It appears in the same form on the ship synoptic code; however, I have rarely seen it used on weather maps.

Wicking on Wet Bulb Thermometer

Yes, the PMO, as part of his vist routine,

is supposed to check the wicking of the wet bulb of the sling psychrometer and change it if necessary. It is also supposed to be changed at sea by the observers anytime it gets dirty or contaminated with sea water spray. To make an accurate measurement, the wicking should be wet only with distilled water (or boiler water).

Barograph pens

Our Engineering Division tested several plastic-tipped pens and said the additional weight would make inaccurate readings. Possibly, there are lighter pens that we should test. However, with the new "no drip" bottles for the barograph ink, you should be able to ink a pen without spilling a drop. The one we have in the office runs over two months without servicing.

Barograph Chart (Barogram) Headings

It is very important that the date and position be marked on each noon position (12Z) on the barogram from the log each time it is changed. Like the other observation forms, these charts must be complete so they can be used and filed separately.

New Barograph Charts

The new barograph charts or barogams (revised Jan-85) now have a range of 955 to 1040 mb or hPa. The previous charts (965-1050 mb or hPa) may be discarded. The new charts should prevent the pen arm from running off the bottom of the charts during many storms. Very low pressure storms, particularly tropical cyclones, hurricanes and typhoons, may still run the pen off the chart. The pen arm should be adjusted early enough so that no data is lost. Be sure to log the amount of pressure adjustment (10 or 20 mb or hPa), so the barograms can be read accurately.

Cloud Pictures

Captain Karl Popp, master, USNS MOH 'K T-AR-170, contributed some excellent cloud pictures which will be used in upcoming publications. Thanks very much.

Home Computer and CW, TTY Weather

Captain Thomas Tighe, Master, ALMEISAN, reports a device that attaches to a home type computer that will copy CW and TTY. For the small ships and coastal vessels without radio officers, this allows them to copy the CW and TTY high seas forecasts. Figure 19 is an example of one of the forecasts on 2 3/4 inch computer tape.

These appear to be similar to the NAVTEX equipment, but with possibly wider application and longer range.

Waves and Swell

"When the wind is 10-15 kn with 1-2 ft wind waves on a swell of about 8 ft, I've seen it reported as "sea" wave of 8-10 feet. Is this a good procedure?"

Not really, or we wouldn't have a sea wave and two swell wave blanks on the 72-1A form. Sea waves and swell are really quite different.

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FORCE WINDS 40 TO 55 KNOTS WITH AVERAGE
SEAS 20 TO 30 FEET NORTHEAST OF A LINE
FROM 50N 35W TO 60N 55W AT 06Z DEC 25 AS
SOCIATED WITH A STORM SOUTHWEST OF ICELA
ND. THESE WINDS AND SEAS WILL RAPIDLY DI
MINISH AS THE STORM MOVES QUICKLY AWAY F
ROM THE FORECAST AREA. DAG FPNT28 KWBC 2
51100 II PART TWO II 12002 DEC 25 1984 .
X  OREOAST X NORTH ATLANTIC NORTH OF 32N
AND WEST OF 35W X EXCEPT AS MENTIONED I
N PART I...WINDS 25 KNOTS OR LESS AVERAG
```

Figure 19. -- Printout of CW weather forecast.

Sea waves are generated by the wind in the development area. They are characteristically steeper and have a shorter period than swell of a similar height. They also have a shorter horizontal crest length than swell. Wind waves might be described as "piles" of water.

Swell are more nearly uniform in height, wave length and horizontal length of crest. They usually are most noticeable outside the wind wave generation area, but they are also in the storm areas, mixed with a great variety of other waves. Waves have a natural sorting procedure that is based on their wave length. Long period waves travel faster than short period waves, so the longer period waves move out of the wind generation area first. Of course, the period of a wave increased with time, so waves traveling a long time from a great distance would be lower, have a longer period, and travel faster than those near the generating area.

When short, steep, slower-moving wind waves are overtaken by swell, the combination both adds and nullifies each other, depending upon their respective phase as shown in figure 20.

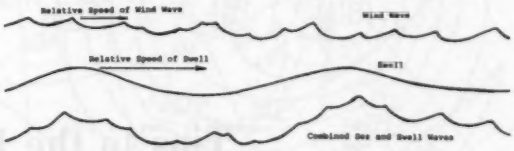


Figure 20. -- Wind wave and swell combination.

Some observers are also in error by reporting the lull areas, where the sea wave and swell are out of phase, as the second swell train. This is easy to do with an undulating surface with parts moving in several directions at once.

This, or course, only touches the subject of waves and swell lightly, but the answer to your question is: Try to separate the sea wave and the swell. These are very important observations, not only to the forecaster and ship router, but to the marine engineer and ship designer. If you don't have a wind wave, you report 20000; and if you don't have either to make a complete report you would report 20000 30000 for the sea and swell groups.

Radar-Weather and Waves

Many issues back in the Mariners Weather Log, I suggested that some radars could be used to detect and track weather, including waves. The face of the wave, as you look upwind will be steeper than the downwind side; so it will produce a stronger, brighter, sea clutter echo upwind, toward the true wind direction.

Second Officer M.D. Sajjad Murshed of the M.V. SEAKITTIE sent in the excellent radar plotting sheet showing the sea clutter extension to the northeast and east in figure 21. The wind was from 060 degrees at 41 kn. As the wind jumped from 17 kn on the previous observation, a SPREP was correctly transmitted. The ship was located at 18.9°N and 144.6°W, course 269°, when this occurred.

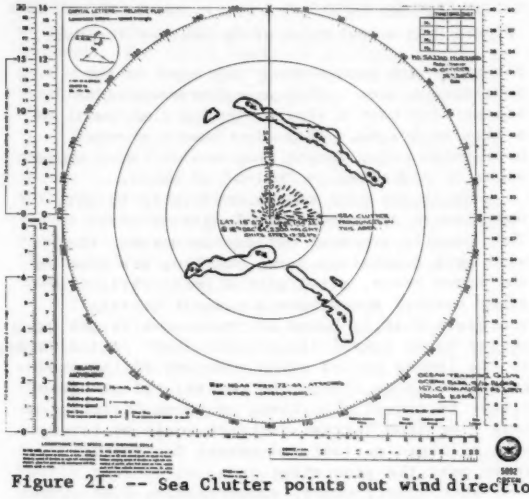


Figure 21. -- Sea Clutter points out wind direction.

PORT METEOROLOGICAL OFFICER CONFERENCE

Because of schedule conflicts the PMO conference dates have been changed to October 29 through October 31.

MEXICO MARINE OBSERVATIONS PROGRAM

It has been reported to me that there is a noticeable increase in the number of ship reports in Mexican waters which is very gratifying. This has also had an effect on the number of reports in the mid and upper Gulf of Mexico. The Gulf of Mexico has always been a hard place to get ship reports, possibly because of traffic.

As part of this same program, we are going to loan the Mexican government a Shipboard Environmental Data Acquisition System (SEAS) terminal. It will be installed on a PEMEX oil platform in the eastern Bay of Campeche. The SEAS will transmit to the GOES satellite and from there the weather report will be relayed to the National Meterological Center (NMC) at Suitland, Maryland, near Washington, D.C. From NMC, the report will be relayed to Mexico City over the Global Telecommunications System.

THANKS

The PMO's forecasters, and of course, myself wish to thank the many masters and observers who have taken the time to write us or use the "Ship's Weather Observation" NOAA Form 72-1A comment page. They have helped to bring about many changes and improvements. We unfortunately, do not have enough time to respond to all, but we try to summarize the general points in the Mariners Weather Log. Again, thanks, and keep them coming.

Tips to the Radio Officer

Julie L. Houston
National Weather Service, NOAA
Silver Spring, MD

WORLDWIDE MARINE WEATHER BROADCASTS
(January 1985 Edition)

The January 1985 edition of Worldwide Marine Weather Broadcasts is being distributed at this time. It is available from the Superintendent of Documents for $7.50 U.S., Stock number 003-017-00522-4. The address for ordering is;

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

MAJOR MARINE WEATHER RADIOFACSIMILE SCHEDULES

The Northwest Ocean Service Center, Seattle, WA has published a booklet entitled Major Marine Weather Radiofacsimile Schedules, Pacific Ocean. It will be updated semi-annually. The publication may be obtained from the: Northwest Ocean Service Center, 7600 Sand Point Way NE, BIN C15700, Seattle, WA 98115, telephone: 206-526-NOAA.

MFAX TRANSMISSION SCHEDULE

MFAX TRANSMISSION SCHEDULE //EFFECTIVE 1 MAR 85//

ADK/ROTA, SPAIN-NGR/ATHENS, GREECE MEDITERRANEAN

XMSN TIME GMT	TYPE	TRANSMISSION CONTENT	VALID TIME
1200/0000	CP/—	FAX SCHEDULE PART1	———
1214/0014	CP/—	FAX SCHEDULE PART2	———
1228/0028	CP/NG	4-PANEL: FRZG LVL ANAL (00/12) FRZG LBL 36HR PROG (12/00), GG THETA ANAL (00/12), GG THETA 36HR PROG (12/00)	
1242/0042	CP/NG	MIDEAST SFC PRES/WND ANAL	00/12Z
1256/0056	CP/NG	MIDEAST SFC PRES/WND 24HR PROG	00/12Z
1310/0110	CP/NG	MIDEAST 500MB HT/TEMP/WND ANAL	00/12Z
1324/0124	CP/NG	MIDEAST 500MB HT/TEMP/WND 24HR PROG	00/12Z
1338/0138	CP/NG	MIDEAST 300MB HT/TEMP/WND 24HR PROG	00/12Z
1352/0152	OPEN		
1406/0206	CP/NG	4 PANEL: 500MB SD/SR ANAL. 500MB	00/12Z
	SD/SR	24HR PROG, 500MB SD/SR 48HR PROG.	
	SD/SR	500MB 72HR PROG	
1420/0220	CP/NMC	4 PANEL: 500MB HT ANAL, 500MB HT 24HR	00/12Z
1434/0234	FB/IN	TEST CHART	———
1448/0248	FB/IN	FSME LERT RETRANSMISSION	12/00Z
1502/0302	FB/IN	NOAA SAT PIC	———
1516/0316	CP/NG	SFC PRES PRELIM ANAL	12/00Z
1530/———		OPEN	———
———/0330	CP/NG	WEST MED SST ANAL	00Z
1544/———	OPEN		———
———/0344	CP/NG	EAST MED SST ANAL	00Z
1558/0358	CP/HR	NORAPS SFC PRES ANAL	12/00Z
1612/0412	CP/HR	NORAPS 500MB ANAL	12/00Z
1626/0426	CP/HR	NORAPS SFC PRES 36HR PROG	12/00Z
1640/0440	CP/NR	NORAPS 500MB 36HR PROG	12/00Z
1654/0454	CP/NR	4-PANEL: SFC PRES 12HR PRDG/SFC PRES 24HR PROG/500MB HT 12HR PROG/500MB HT 24HR PROG	
1708/0508	CP/NG	SFC PRES ANAL (FINAL)	00/12Z
1722/0522	CP/NG	500MB HT/TEMP/WND ANAL	00/12Z
1736/0536	CP/NG	850MB HT/TEMP/WND/ ANAL	00/12Z
1750/0550	CP/NG	300MB HT/ISTCH/WND ANAL	00/12Z
1804/0604	CP/NG	400MB HT/TEMP/WND ANAL	00/12Z
1818/0618	CP/NG	925MB HT/TEMP/WND ANAL	00/12Z
1832/0632	CP/NG	700MB HT/TEMP/WND ANAL	00/12Z
1846/0646	CP/NG	200MB HT/TEMP/WND ANAL	00/12Z
1900/0700	CP/NG	SFC PRES/WND 24HR PROG	00/12Z
1914/0714	CP/NG	500MB HT/TEMP/WND 24HR PROG	00/12Z
1928/0728	CP/NG	850MB HT/TEMP/WND 24HR PROG	00/12Z
1942/0742	CP/NG	300MB HT/ISTCH/WND 24HR PROG	00/12Z
1956/0756	CP/NG	400MB HT/TEMP/WND 24HR PROG	00/12Z
2010/0810	CP/NG	925MB HT/TEMP/WND 24HR PROG	00/12Z
2024/0824	CP/NG	700MB HT/TEMP/WND 24HR PROG	00/12Z
2038/0838	CP/NG	200MB HT/TEMP/WND 24HR PROG	00/12Z
2052/0852	CP/NG	4 PANEL: 500/1000MB THICKNESS ANAL, 500/1000MB THICKNESS 12HR PROG, 500/1000MB THICKNESS 36HR PROG, 500MB HT/TEMP/WND 120HR PROG	00/12Z
2106/0906	CP/NG	SFC PRES/WND ANAL., SFC PRES/WND 36HR, 500MB H/T/W ANAL, 500MB H/T/W 36HR	12/00Z
2120/0920	CP/NG	SFC PRES (06Z/18Z) PRELIM ANAL	06/18Z
2134/0934	CP/NG	SFC PRES/WND 36HR PROG	12/00Z
2148/0948	CP/NG	850MB HT/TEMP/WND 36HR PROG	12/00Z
2202/1002	FB/IN	FSME LERT (36HR SFC PRES/WND PROG	12/00Z
2216/1016	CP/NG	500MB HT/TEMP/WND 36HR PROG	12/00Z
2230/1030	CP/NG	SFC PRES/WND 48HR PROG	00/12Z
2244/1044	CP/NG	500MB HT/TEMP/WND 48HR PROG	00/12Z
2258/1058	CP/NG	SFC PRES/WND 72HR PROG	00/12Z
2312/1112	FB/IN	NOAA OR METEO SAT PICS	
2332/1132	FB/IN	OSME LERT (36HR SIG WAVE HT PROG)	12/00Z
2346/1146	CP/NG	4-PANEL 850MB HT/TEMP/WND 48HR PROG 500MB 72HR HT PROG 850MB 72HR HT PROG 700MB 48/72HR PROG (HTS ONLY)	00/12Z

NOTES:

CP - COMPUTER PRODUCT
NG NAVAL OCEANOGRAPHIC GLOBAL ATMOSPHERICS PREDICTION
NR NAVAL OCEANOGRAPHIC REGIONAL ATMOSPHERICS PREDICTION
NMC NATIONAL METEOROLOGICAL CENTER (WASHINGTON D.C.)
FB FLATBED SCANNING PROCESS
IN IN HOUSE PREPARED PRODUCT

PROJECTION AREAS

1. POLAR STEREOGRAPHIC-24N, 029E/55N, 065E/63N, 050W/27N, 012W
2. POLAR STEREOGRAPHIC-16N, 034E/54N, 087E/55N, 068W/16N, 014W
3. POLAR STEREOGRAPHIC-27N, 042E/49N, 049E/49N, 011E/27N, 017E
4. POLAR STEREOGRAPHIC-27N, 023E/48N, 030E/48N, 013W/27N, 006W
5. POLAR STEREOGRAPHIC-20N, 036E/46N, 048E/51N, 017W/20N, 007W
6. INDIAN OCEAN MERCATOR-10S, 090E/50N, 090E/50S, 020E/10S, 020E
7. POLAR STEREOGRAPHIC-60N, 030W/55N, 050E/20N, 010W/20N, 030E
8. POLAR STEREOGRAPHIC-26N, 010E/74N, 020E/40N, 065W/17N, 034W
9. NORTH ATLANTIC-27N,020E/78N, 040E/46N, 064W/20N, 023W

FREQUENCIES: 4704 (1800-0600Z): 12759 (0600-1800Z); 9875 (C)
4053.5 (1800-0600Z): 17585 (0600-1800Z); 7453 (C)
AVAILABLE UPON RQST: 7669.5, 8506, 20470; 23682

TIPS TO THE RADIO OFFICER (from Jerry Nickerson)

NIGHTIME WEATHER REPORTS

The weather is continually changing and some people are more affected by these changes than others. Ships at sea are greatly affected. Whether you use the National Weather Service general forecast or a more specialized forecast from a ship routing service, the small number of ship weather reports at night makes for poor morning forecasts. This was illustrated in figure 47 borrowed from page 36, Winter 1985,

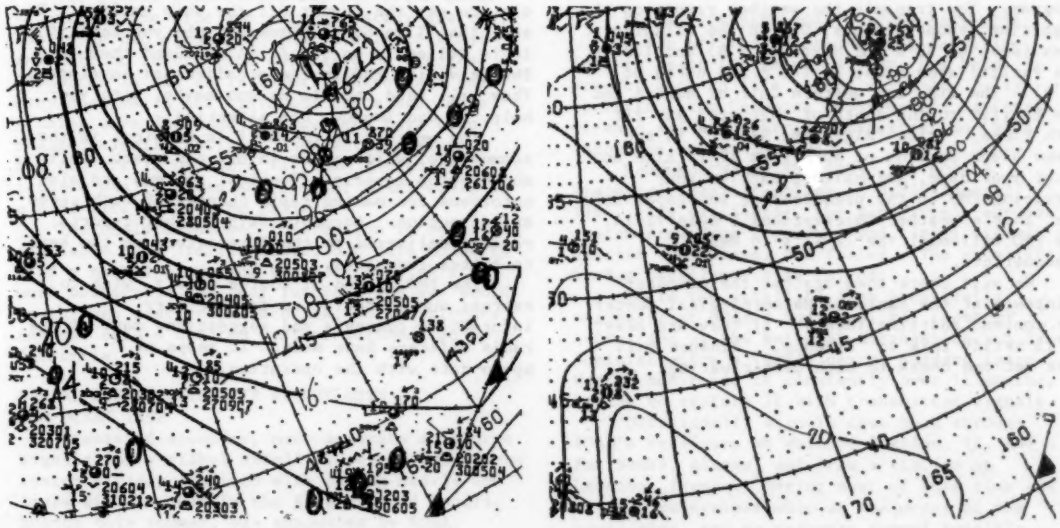


Figure 22. -- Notice the difference in the number of ship reports plotted on the 0000 chart (left) and the 1200 chart (right) for October 1.

MWL (fig. 22).

The little numbers in the dotted circle on the maps are ship reports that were too close to others to be plotted. They will be plotted around the border so the forecaster uses all the reports. They are circled in black for emphasis on the left map.

The reason for this difference between the daytime and nighttime weather reports is the radio officer is off watch and the weather report doesn't get transmitted. However, the observations are still being made and recorded. They are used for climatological purposes -- not forecasts. Everyone, including the radio officer, is entitled to time off after a long day's work, but the dilemma is -- how to get weather reports on that nearly blank nighttime weather map.

Last year, we asked a lot of radio officers for suggestions. Some said, "That's tough," but many said they got up once or twice at night anyway, so they would set an alarm and send the nighttime weather report. Some of you have done this, and it is greatly appreciated, as it makes a great difference in tht early morning weather map.

Now we are going one step further by developing a voluntary test program in which we will give ten dollars ($10.00) for each nighttime off-watch weather report from U.S. flagship radio officers, if their company is participating in the program. Because of the money-handling constraints at this time, this program must be limited to: 1. U.S. flag ships, 2. U.S. companies that enter into agreement with NWS on disbursing money, and 3. the radio officer must be off watch and participate as a volunteer.

All three conditions must be met. The way is will work is after your company officers have agreed with the National Weather Service (NWS) to disburse the program funds, they should notify you that you may participate in this program. You transmit the weather report on the nighttime synoptic hours, 06Z in the Atlantic area (west of 35°W and north of 3°N) and 12Z in the Pacific area (east of 160°E and north of 25°S). The mid- and western Gulf of Mexico and the Pacific to the south of that area may fit both times. Write "Nighttime Report" in the lower blank portion of NOAA Form 72-1A sign and print your name, and mail it back to your servicing PMO in the preaddressed envelopes for the "Ship's Weather Observations," NOAA 72-1A. The PMO will mail the 72-4A's to NWS Headquarters.

We will check them against the computer printouts at the National Meteorological Center for content and timelinesss. If they are okay, we'll verify this to "Finance." Finance will make out one check to each participating company. The company will disburse the program funds according to our list to the radio appropriate officers.

KEEP IT SIMPLE

Please help us keep communications short and simple by using the following procedures to make weather reports:

INMARSAT

1. Select U.S. Coast Earth Station identification Code 01
2. Select routine priority.
3. Select duplex telex channel.
4. Initiate the call.
5. Upon receipt of GA+ (Go Ahead), select Code 41+.
6. The response will be our answerback, NWS OBS MHTS, which will appear on your screen.
7. Send your call and weather message. End the message with 5 periods.
8. Terminate the call with a manual disconnect.

You should NOT have any preamble, your answerback number, or your ship's name after the GA+. Your screen or message copy should look like this:

```
GA+
41+
NWS OBS MHTS
WLXX 29003 99131 70808 42998 60909
22234 20201 30000 .....
```

The GA+ and NWS OBS MHTS are answerbacks, the rest you add.

The Spring 1985 Volume 29, Number 2 has the complete communications procedures as does the annual "Hurricane Alert" letter.

GULF OF MEXICO REPORTS

Although we are getting more reports in the Gulf, a lot are still coming in quite late, often too late for the forecast. Can you help us out with some reasons for this. Better yet, can you get the report off the ship earlier. Be sure the "Time Sent" blank and who you sent it to is filled in on the 72-4A's. Send them to the Servicing PMO in the preaddressed envelopes. They will send them to me and maybe, with your help, we can improve the situation.

The weather in the Gulf is tropical in the summertime, which means things can start small and develop rapidly. Tropical systems are also notorious for making rapid changes of both speed and direction. Accurate ship weather reports, rapidly delivered to the forecaster are the keys to better forecasts.

The PMO's, and of course myself, wish to express our appreciation for the very informative comments and suggestions many of the radio officers have made. It keeps us up-to-date with the operation.

The Editor's Desk

EDITORIAL FROM THE MARINE OBSERVER

In the Spring 1985 issue of the Mariners Weather Log I reprinted an Editorial from the January, 1985 issue of The Marine Observer.

The Editorial was by Doctor John T. Houghton, Director-General of the UK Meteorological Office, not Captain John F. Houghton as indicated. My apologies to both Doctor Houghton and Captain Houghton.

Elwyn E. Wilson, Editor, Mariners Weather Log.

TIDAL DATA BY WEATHERFAX

Tide tables furnished by the National Oceanic and Atmospheric Administration (NOAA) long have been a valuable aid to boaters, and soon that information may be available by weatherfax that could detail actual tide and current conditions

Dr. John Hays, director of NOAA's Office of Oceanography and Marine Assessment, said a new system is being tested in the Delaware Bay and in Miami's Government Cut that may revolutionize tidal and currents information.

A system of sensors is placed in the body of water to be monitored and information on depth, tide and current is then relayed to a shore point, where the data can be transmitted to vessels preparing to enter the waterway.

The main advantage to this system is that the information details exact tidal and current action and not the hypothetical conditions that are predicted in tables. Currents can be affected by river flow, winds and other conditions that cannot be taken into account on the tables that are published.

The information being compiled now in Delaware and Miami is not currently available to the average boater, but it is being used by government analysts and in Miami by the Biscayne Bay Pilots Association.

The pilots association was the prime mover in getting the tide and currents study started. The group had complained that available tidal and current information was based on studies conducted in the early 1930s. There have been many changes in the basin and cut since those studies were done and the currents have been changed significantly. They were working on the project in Delaware Bay when the pilots' request was received and thought Miami would be a good site to try the project.

The newly developed information is only available on a limited basis, but Hays hopes to find a method of making the data available to more boaters in the near future. One way would be through weatherfax machines, where skippers can now obtain updated weather information by facsimile.

SARSAT/COSPAS SATELLITE RESCUE GETS TWO-OCEAN TEST

Tests of speedier, more accurate shipborne signals for a global satellite search-and-rescue system already credited with saving nearly 400 lives will be held in the Atlantic and Pacific oceans this summer, was announced by NOAA.

The system, Search and Rescue Satellite-Aided Tracking (SARSAT) and COSPAS, its Russian equivalent, is a multinational effort to save lives of mariners and airmen in distress.

The Commerce Department agency said the test will measure the seaworthiness of a new satellite emergency radio signal system operating on a 406 Megahertz (MHz) frequency, which has been found to be a major improvement over the international 121.5 MHz aircraft frequency, in use for the past half-century.

A joint exercise of NOAA and the National Aeronautics and Space Administration (NASA), its principal participants are NASA's Goddard Space Flight Center, Greenbelt, Md., and seven of NOAA's National Ocean Service ships.

The program will evaluate reliability and accuracy of shipborne distress beacons via two U.S. and two Soviet polar-orbiting satellites 500 mi above the earth. If the system is efficient, it may be adopted by the UN's International Maritime Orgnaization (IMO) for use by the world's 45,000 merchant ships, beginning in 1993.

The system will let satellites report distress signals quickly from any spot on earth; the 121.5 MHz system blanks out large areas of the world. The 406 MHz system enables a satellite to record and store a signal and then transmit it to the first ground station encountered. It will also permit satellites to pinpoint distress locations within 1 to 5 mi, against the present 5 to 10 mi radius.

Now, both the distress site and the receiving station must be on a line of sight with the orbiting satellites. For example, signals from a ship sinking in the Pacific could be heard by a satellite but could not be relayed to rescue centers because there are no receiving stations in ocean areas.

SCIENTISTS SAVE NOAA WEATHER SATELLITE

A $50 million polar-orbiting satellite, dead in space for nearly a year, has been brought back to life and is virtually fully operation, the Commerce Department's National Oceanic and Atmospheric Administration (NOAA) announced on May 24, 1985.

Launched March 28, 1983, the NOAA 8 spacecraft began tumbling in orbit June 12, 1984. Its oscillator, the satellite's nervous system providing frequency and timing signals to all its sybsystems, had failed. The satellite's backup oscillator also failed.

While the satellite flew erratically, engineers at NOAA's Suitland, Md., control center and at the National Aeronautics and Space Administration's (NASA) nearby Goddard Space Center monitored it constantly over 11 months, trying to restore it with transmitted signals.

Occasionally signals came back through NOAA's receivers at Wallops Station, VA. and Fairbanks, Alaska, and from a station at Lannion, france. During most of this time the craft's subsystems were at the mercy of the oscillator, and no recovery seemed possible.

In the last 2 months, however, signals

began to indicate that the backup instrument was beginning to assert control. The recovery effort went into high gear April 20 when the prime oscillator died and the craft's circuitry switched completely to the backup instrument. Tom Karras, NOAA's control center chief, mobilized his counterparts at NASA and at RCA Astro-Electronics Division, Princeton, N.J., builders of the spacecraft, for an all-out effort.

Under the guidance of Gay Hilton, NASA'S meteorological satellite systems engineer at Goddard, RCA designed special computer instructions which were transmitted to NOAA 8's computer beginning May 1. This program used the pull of the earth's magnetic field to gradually halt the spacecraft's tumbling and spinning motion. At 6:18 p.m. Friday, May 10, the computer "sensed" that the spinning had stopped and issued signals that stabilized the spacecraft.

For the past week, the satellite has been undergoing a complete checkup to determine whether its instruments are capable of functioning continuously 500 mi above the earth. After evaluating test results, NOAA and NASA today declared the spacecraft fully operational except for an atmospheric sounder which was damaged by the erratic flight of the past year.

After its instruments are calibrated with the earth data processing system, NOAA 8 will resume daily delivery on or about July 1 of a wide range of earth and atmospheric imagery and measurements to nations on four continents. The satellite's return to service will also double U.S. capability for the international satellite search and rescue system (SARSAT). For the past year and a half of the United States has had at most a single operational SARSAT-equipped craft aloft -- and for a six month period none -- while the Soviet Union, its rescue partner, had two such satellites operating.

NOAA-8 now teams up with NOAA-9, a twin weather/rescue satellite launched Dec. 12, 1984.

LETTERS TO THE EDITOR

BERING SEA WEATHER: JANUARY 21 THROUGH FEBRUARY 15

This memorandum was sent by the Commanding Officer of the NOAA ship MILLER FREEMAN to the Director, Pacific Marine Center, Seattle, WA with a copy to the Mariners Weather Log. It describes the weather over the Bering Sea from January 21 through February 15, 1985.

The NOAA Ship MILLER FREEMAN operated in the Bering Sea from 21 January through 15 February, 1985. We experienced weather quite different from what we expected: air temperatures were initially quite warm, winds were southerly and variable in strength (ranging from 10 to 50 kn), and we encountered frequent squall lines as small scale LOWs and their associated fronts passed over the Aleutians from the south, traveling at 30-40 kn. The ship ported in Dutch Harbor in early February and we experienced spectacular weather: continued warm air temperatures, lower humidity and crystal clear skies.

For five days (February 4 through 8) we experienced surface pressures continuously above 1040 mb and as high as 1048 mb. ENS Kenneth Kramer, the ship's meteorology officer, advised that the surface high pressure system itself, was of the transitory type which generally accompany mid-latitude cyclonic ciruculations. The high pressure was able to build and persist as a result of an unusually strong ridge in the upper level. This particular upper level ridge pattern, known as an omega block, is a very stable condition due to a split flow in the jet stream. This ridge had existed and had been a major influence on our weather patterns since we arrived at our working grounds in late January. Until February 8 we were on the west side of the upper level ridge, hence the strong southerly flow and unseasonably warm temperatures. However, with the slight retrograde in the position of this ridge we experienced northerly flow on the east side of both the upper level ridge as well as the accompanying surface high.

With the north wind ranging from 30 to 50 kn, air temperatures immediately dropped, seas rose and spray ice conditions developed rapidly. The surface pressure gradually fell as the axis of ridge moved away from our position and a stationary low pressure trough in the Gulf of Alaska became the dominate influence. Winds averaged 30 kn out of the north and temeperatures averaged -5 degrees C for the remainder of our time in the Bering Sea. The upper level ridge gradually weakened and by February 16 became cut off thus enabling the transitory LOWs to track northeastward along the now continuous jet stream. On our transit to Kodiak, we were overtaken by a developing LOW with southeasterly 40 kn winds. The stable blocking ridge had broken down and we experienced the more familiar pattern of a continuous jet stream and transitory LOWs tracking from east of Japan to the Gulf of Alaska and eastward.

WATERSPOUT, SEPTEMBER 18, 1984

The following letter and photograph was received from John T. Peterlin III, Master of the Research Vessel ROBERT D. CONRAD. The ship is operated by Lamont-Doherty Geological Observatory of Columbia University.

Dear Sirs,

I am enclosing with this correspondence three photographs for your attention and interest. The photographs were taken on 18 September, 1984 while this ship was conducting a

Figure 23.-- A close-up of the waterspout.

survey in the Central Atlantic. The waterspout shown was passed at its closest point at a distance of 0.5 nautical miles. The waterspout was sighted at 1922 hours while the ship was in Latitutde 23° 28.7'N and Longitude 046° 12.5'W on a gyro course of 098 degrees true(fig.23). The photographs were taken from the ship's starboard Bridge Wing at a height above the water of approximately twenty-eight feet at camera level. The meteorological conditions existing at the time were as follows: Wind ESE, force 3; Barometric pressure 1018.5 millibars and rising; Air Temperature - Dry bulb 27° Celsius, Wet bulb 24° Celsius; Sea Surface Temperature - 28.9 degrees Celsius. The waterspout was not accompanied by storm conditions or any other unusual weather conditions. The photograph was taken by this correspondent with a Minolta XG9 camera using Kodacolor VR 1000 film. The time of sighting given above is G.M.T.

The Research Vessel Robert D. Conrad is an AGOR class oceanographic research vessel operated by Lamont-Doherty. The ship was engaged at this time in geological and geophysical survey on a world-wide basis, spending an average of over three hundred days underway at work each year. We expect to surpass one million miles of research and survey track in the near future, accumulated over twenty working years on all of the world's oceans.

Hoping that you may find the enclosed photographs of some use I am,

Yours Sincerely,
John G. Peterlin III, Master

DOWNBURST WINDS

This letter was received from Robert D. O'Brien, Captain of the SCOTCH MIST II out of Lahaina Maui, Hawaii.

The 1985 Winter issue of Mariners Weather Log contained an article "Marine Observations Program" by J.W. Nickerson. The subject was Freak Waves and Extreme Storm Waves.

Mr. Nickerson was indicating the downburst phenomenon was the probably cause for the occurance of such extreme waves. I have never experienced a wave of the type described, but have certainly been involved in a number of downbursts that were truly unsettling. All of my experience with the downburst has occurred on high performance sailing vessels either racing or in carrying passengers for hire.

I first became aware of their destructive power while sailing in the lee of the West Maui Mountains just south of the town of Lahaina in the Hawaiian Islands. In heavy northeast trade wind weather the wind will ascend the northeast side of the Island and rapidly descent the southwest side. The southwest air has been cooled by the approximate 5,500 ft elevation of the mountains so the descending air is denser that the normal surface air.

The normal condition in the area is a sea breeze in the 6-10 kn range which is generated by the land mass warming and pulling the cooler ocean air ashore in a typical thermal fashion. If the tradewinds are light (under 25 kn), the termal updraft seems to keep the trade wind descent from hitting the surface. As the trades build however the downbursts break through and can cause the unwary some moments of extreme anxiety.

Mr. Nickerson's sketch figure 25a portrays the situation accurately for a moving weather system. In a static situation (caused by a fixed object such as a mountain) an additional phenomenon can be observed. Between the leading edge of the downburst and the counter wind in front of it is a band of dead calm. This area of calm makes the downburst even more destructive to a vessel under sail power alone. The calm greatly reduces the vessels way on, so when the downburst hits the force causes even greater heeling force than it would if the vessel had good way on. If the vessel has way on the force will cause the vessel to heel, but a certain amount of the force will be absorbed as the vessel accelerates.

A sailor used to the local conditions will keep a weather eye out to the shore at all times. The difficulty would be magnified by darkness and the inability to see the downburst coming. The calm may lull the unwary into thinking the wind had quit and be unprepared for the downburst which may back the sails and cause extensive damage.

Normally as the wind increases a prudent sailor will reef so as to reduce heeling and the leeway resulting. The normal gust will cause the boat to heel a bit more, effectively reducing the sail surface presented to the wind. A downburst, however, will cause even greater heeling as the gust is closer to a right angle to the sails, so the safety valve effect of a reefed sail is negated.

Figure 24 shows sketches which may help in explaining the situation.

Downbursts also occur in the open ocean during heavy tradewind weather particularly at night. During the daytime the surface temperature is warmer which seems to serve as a cushion, so when a squall hits the increase in wind velocity is not nearly so great as at

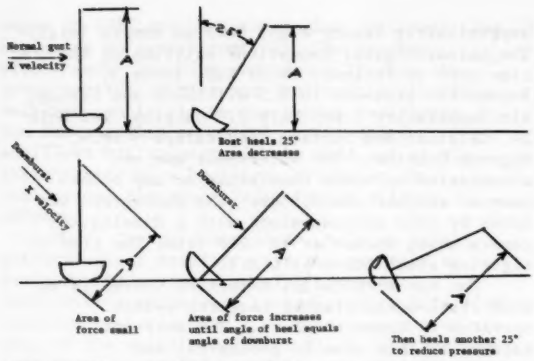


Figure 24.-- A sketch of how a normal gust and a downburst gust affects a sailboat.

night. This has been confirmed to me during the sailing of several races from the Mainland to the Hawaiian Islands.

I cannot say for certain, but it seems that the wind velocity produced from a squall is usually double that of the prevailing wind. It also seems that as the average wind velocity at the surface increases, the winds produced from a squall increase proportionately in velocity, and the air descends at a steeper angle.

The article mentions Stevenson's account of the sinking of the barque MARQUES. "The wind struck from the port quarter, the bow buried rolling the MARQUES on beam ends after 10 seconds". This statement is true of the reaction of any sailboat under the same conditions. The downward force of the wind buries the bow, and the sails which are on the starboard side (port tack) serve as a lever to spin the boat around the keel and at the same time cause the boat to heel over onto its beam ends. As this occurs the rudder is usually out of the water and the helm cannot respond. An open hatch lets in the sea, and the rest is history. The only way to counteract this is to bear off downwind as soon as the blast first hits, or if the helmsman can't react, release the sheets and let the sails flog. Two things that a duty watch on any sailboat must be always prepared to do at any moment.

A heavy displacement vessel is more susceptible to this situation than the lighter displacement vessels currently being raced today. Lighter displacement allows sudden force to be translated rapidly into acceleration rather than heeling moment. You can still get into trouble though, and the same recovery techniques are applicable.

The following excerpts from the log of SCOTCH MIST II illustrate a similar situation. The account was during the Race from Victoria BC, Canada to Lahaina Maui, July of 1982.

SCOTCH MIST II is a Santa Cruz 50 sloop built by Bill Lee Yachts of Soquel California. LOA 50', LWL 47.5', BEAM 12' DRAFT 8', BALLAST 8,000 LBS., DISP. 16,500 LBS.

Tuesday July 13: Race Day 11
Noon position: Lat. 27° 25'N, Long 137° 43'W.

Days run noon to noon 221 mi.
"The sea state is very confused due to a hurricane (Daniel) a thousand miles or so southeast of us. We are getting the normal trade wind swells from the northeast as well as a cross-swell from the southeast. The confusion makes for difficult steering and we are just on the verge of being out of control. About 2300 a whopper of a squall hits us and the wind goes up to 40 kn (apparent wind). The boat responds by taking off on a screaming plane that seems to last half an hour (probable duration 5 min.). We sustained speed over 18 kn, with bursts over 20 and finally a whopping 23 kn. Dave Nottage who is steering says in a voice about an octave higher than normal, "We have too much sail up". So we shortened down etc.

Thursday July 15, Race day 13
Noon position: Lat 25°. 56'N, Long 146°. 49'W.

Days Run noon to noon 248 mi.
"Nightfall finds us booming along in an ever-increasing wind. We should have known that something was in store for us, this being the 13th day. At 2300 that night all hell broke loose. A granddaddy squall hit with all the force of a runaway cement truck. We were knocked down flat for about 5 min. Nothing we did seemed to relieve the pressure. The main sail and vang were dumped, the spinnaker sheet set free, and the helm hard down to leeward. Finally after an eternity of agony, we were able to bear off and get her back on her feet. Getting the spinnaker down and all of the sheets and guys aboard was an all-hands effort that took another half-hour. During the process with only a main set we were still being knocked down and the decks were awash. It was a hold on for your life fire drill, and when it was all over we had lost a spinnaker sheet and guy, plus all the man overboard gear which had been lashed to the starboard side of the stern pulpit. Finally a No. 3 jib was swung out on a spinnaker pole. The boat was easy to control, and there was no loss of speed."

I might add the crew was a very experienced one indeed, and that safety harnesses are always worn at night. Two and a half days later we were the first to cross the finish line at Lahaina.

This second squall was one of the true downburst variety. It lasted for over two hr and with just a mainsail up our speed never dropped below 10 kn and we at times hit 18 kn. Wind spped was in the 40 kn range with gusts to 65 kn (true wind speed). It was not a pleasant experience, and I was glad to learn from your article what was really going on. Although we did not encounter any extreme wave per se, the sea generally became substantially steeper during the whole occurence.

MARINE WEATHER REVIEW

The Weather Logs combined with the cyclone tracks, U.S. Ocean Buoy climatological data, gale and wave tables, and mean pressure patterns are a definitive report on the weather systems and primary storms which affected the North Atlantic and North Pacific Oceans during this 3-mo period. Hurricane Alley lists and describes tropical cyclones worldwide. Unless stated otherwise, all winds are sustained winds and not gusts; all times are G.M.T.

North Atlantic Weather Log
January, February and March 1985

WEATHER LOG, JANUARY 1985 - There were major differences in the storm tracks this month and the climatological tracks. The storms followed one of the climatological tracks that stretches from near Cape Hatteras to Cape Race and into the Labrador Sea. A climatological track from near Cape Hatteras to Iceland did not exist. The cyclones over the eastern half of the ocean were widely scattered. There were two cyclones that traversed the Mediterranean Sea and two more that entered the Liguarian Sea.

The mean sea-level pressure chart reflected the storm tracks or you could say help explain their displacement from normal. The Icelandic Low was 988 mb-13 mb lower than normal and displaced to 54°N, 52°W. This was about 600 mi southwest of its climatic position (fig. 25). The Azores High was near normal at 1021 mb at 28°N, 29°W. There was a 1011 mb LOW over the North Sea and another 1010 mb LOW near Rome, Italy. There was an anomalous HIGH north of Scoresby Sound on the east coast of Greenland.

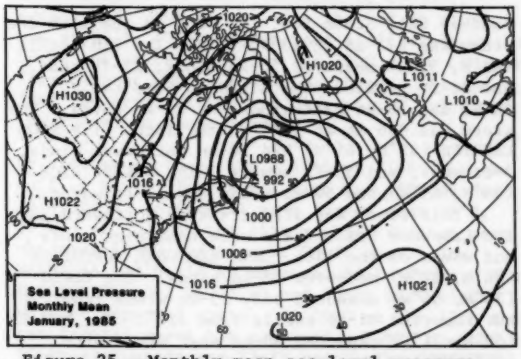


Figure 25.--Monthly mean sea-level pressure.

The were two large anomaly centers. One was minus 19 mb near Hamilton Inlet on the Labrador coast. The other was plus 13 mb on Iceland's east coast. Most of the ocean north of latitude 30°N was negative. The western boundry was the Mississippi Valley. On the northeast the zero isoline stretched from near Kap Farvel to Lands End.

The upper-air pattern at 700 mb was more intense than normal. The LOW was displaced southward to near Goose Bay from Baffin Island and 51 meters lower than normal at 2627 meters. The 3150 meter isoline was near normal between Cuba and Florida. This produced a tight gradient over the western part of the ocean. The normal flat ridge over western Europe was greatly accentuated with an anomalous high center between Iceland and the Faeroe Islands.

Some Climatology -- On January 1, 1864 snow, gales, and severe cold hit the Midwest. At Chicago the high temperature was minus 16°F. On the 18th in 1817 a luminous snowstorm occurred in Vermont and New Hampshire. St. Elmos fire appeared on roof peaks, fence posts and even hats and fingers of people. Thunderstorms were over central New England. On the 25th in 1821 the Hudson River was frozen solid, the coldest winter in 41 yr. Thousands crossed the ice from New York City to New Jersey. Refreshment taverns were set up in the middle of the river to warm pedestrians.

Extratropical Cyclones -- The year began with a large HIGH off the U.S. East Coast and a narrow north-south ridge off the west coast of Europe. The Azores High was shifted over North Africa. By midweek a severe storm had developed west of Portugal and moved northward. A HIGH east of Iceland intensified. At the end of the week a severe LOW moved over Newfoundland. The subtropic HIGH had drifted eastward and a storm was moving across the Mediterranean. The worst cold wave in 30 yr hit western Europe including the Mediterranean area.

The second week another storm moved across the Mediterranean. High pressure continued over the central east coast of Greenland. High pressure over the subtropics weakened. A storm formed over New Jersey. At midweek there was another blocking ridge west of Europe but the HIGH over Greenland was gone. High pressure moved off Cape Hatteras near the end of the week. The Azores High intensifed with another over Scandinavia.

On the 16th another severe LOW was off the U.S. East Coast. There was high pressure from the Azores to the Baltic Sea with a 1046 mb center. There were weak LOWs over southern Europe. By midweek the high pressure had retreated eastward. Another LOW developed north of the Azores. A 1060 mb HIGH over the North Pole kept cyclones to the south.

The first of the fourth week found the Polar High weakening but a ridge extended

southward along longitude 35°W to the subtropical High. There were two significant LOWs, one on each side of the ridge, over Labrador and Scotland. The cyclonic circulation around the Labrador LOW extended from Lake Winnipeg to south of Iceland and latitude 30°N to 80°N on the 23d. A few days later it broke up into many small LOWs. The end of the week one of these off New England developed into a severe storm. This storm dissipated by the end of the month and HIGHs over Spain and Bermuda were large features.

This storm formed north of the Azores on January 2. On the 3d it was 984 mb near 49°N, 27°W with storm-force winds. the TFL INDEPENDENCE (43°N, 33°W) measured 52-kn winds from the northwest. The GOTS (40°N, 29°W) also had 52-kn winds and she reported 41-ft seas, and 46-ft swells. The REYNOLDS (40°N, 30°W) had 44-kn winds, 33-ft seas, and 36-ft swells. By 1200 on the 4th there were four small LOW's in the circulation. ROMEO had 41-ft swells. The total circulation now included the Grand Banks. The SEDCO 706 had 50-kn west winds and 20-ft seas. The RAPID (44°N, 35°W) had 60-kn west winds and 25-ft seas. The ZABRZE (49°N, 18°W) had 60-kn southeast winds, 12-ft seas, and 38-ft swells. Her winds were 55-kn and swells 36-ft on the 5th. The SEA-LAND VOYAGER (49°N, 13°W) measured 48-kn winds and 30-ft swells. This storm was gone by the 6th.

The Gulf Stream off Cape Hatteras was the mother of this cyclone late on the 3d. It intensified rapidly to 976 mb off Cape Cod on the 5th. There already were storm-force winds and swells to 33-ft. At 1200 on the 6th the storm was 956 mb on the north coast of Newfoundland (fig. 26). There were many strong wind and high wave reports. SEDCO 706 reported 62-kn winds with others on the Grand Banks reporting up to 60-kn. The TFL FRANKLIN (35°N, 53°W) measured only

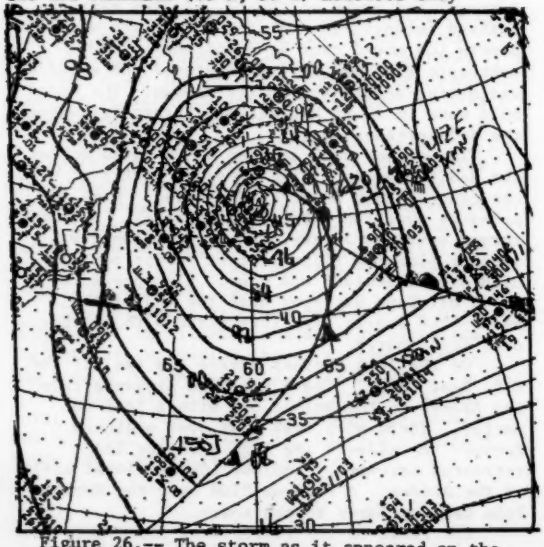


Figure 26.-- The storm as it appeared on the analysis of 0000 January 6.

38-kn with 12-ft seas, and 25-ft swells. The ROWAN JUNEAU (44°N, 60°W) measured 60-kn winds, no waves reported.

The storm was 970 mb over Goose Bay on the 7th and a frontal wave had formed near 51°N, 37°W. The many high wind and wave reports continued. The MAASSLOT (41°N, 51°W) had 50-kn winds and 33-ft seas and swells. The RAPID (48°N, 23°W) still had 50-kn winds and 30-ft swells. The ACADIA (36°N, 48°W) found only 30-kn with 33-ft swells. The storm started to break up on the 8th as another storm moved off Long Island.

As a LOW moved eastward over the Ohio Valley and approached the western slope of the Appalachian Mountains on the 7th a new LOW formed on the eastern slope. The TFL FRANKLIN (34°N, 67°W) measured 40-kn winds, 12-ft seas, and 30-ft swells on the 8th. The SEA-LAND LEADER (40°N, 64°W) measured 60-kn west winds, 23-ft seas, and 25-ft swells. At 1200 on the 9th the 975-mb storm was near 53°N, 46°W. The DART CONTINENT (41°N, 52°W) measured 67-kn west winds, 10-ft seas, and 35-ft swells. The ZIM NEW YORK (42°N, 53°W) estimated the wind as 75 kn. CHARLIE measured 39-kn south winds, 20-ft seas, and 25-ft swells. At 1200 on the 10th the storm was west of Kap Farvel. The KENNETH E. HILL (39°N, 63°W) measured 55-kn winds. The MAASSLOT (41°N, 56°W) was sailing into 50-kn winds and 33-ft seas and swells. The storm remained quasistationary as a second LOW moved northward in the eastern guadrant on the 11th. The NAVIOS ENTERPRISE (37°N, 46°W) measured only 17-kn winds from 270° but reported giant 56-ft swells from 300°. The EXPORT CHAMPION nearby (36°N, 49°W) reported 25-ft swell. The storm dissipated on the 12th.

Another Gulf Steam LOW. At 1200 on the 12th the storm was 972 mb at 43°N, 57°W. The ZIM IBERIA (42°N, 55°W) measured 50-kn winds, 13-ft seas, and 26-ft swells. The ATLANTIC SONG (45°N, 56°W) had 53-kn east winds and 23-ft waves. The storm was 966 mb at 1200 on the 13th. The SCOL CARRIER (38°N, 65°W) had 30-kn northwest winds, 7-ft seas, and 33-ft swells. The WALTER RICE (35°N, 69°W) had 50-kn winds and 17-ft waves.

This storm was also tracking northward into the Labrador Sea. There were some high winds and waves on the 14th. The NACIONAL MONCHIQUE (36°N, 37°W) measured 58-kn winds. The EEKLO (38°N, 55°W) measured only 13-kn winds from 290° but reported 41-ft swells from 310°. The MHV 68 (60°N, 31°W) reported 60-kn east winds with 46-ft seas. The storm started to weaken rapidly on the 15th.

The following four ships suffered damage due to weather at Marystown, Newfoundland on the 12th; ATLANTIC BEATRICE, NEW FOUNDLAND HAWK, ZAMBEZI, and ZIDANI. The CITY OF PERTH lost eight containers overboard.

This was one of those storms that probably could be classified a "Bomb". The 0000 chart of the 15th showed a LOW near Montreal, a weak LOW over the Bay of Fundy and frontogenesis off the U.S. East Coast. The 1200 chart showed a 976 mb

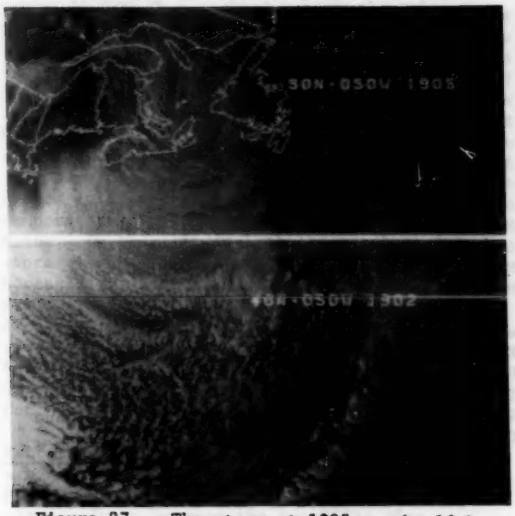


Figure 27.-- The storm at 1905 on the 16th.

storm at 40°N, 64°W. Wallops Island, VA had 46-kn winds. The EXPORT CHAMPION (37°N, 69°W) found 45-kn west winds, 13-ft seas, and 35-ft swells. Another ship at 38°N, 60°W reported 50-kn winds, 21-ft seas, and 31-ft swells. At 0000 on the 16th, 24 hr later, the storm was 962 mb near 46°N, 60°W (fig. 27). There were many observations of storm-force and higher winds plus extreme waves. One was the EXPORT FREEDOM (36°N, 50°W) with 50-kn southwest winds, 25-ft seas, and 49-ft swells. The CLERK-MAXWELL (34°N, 54°W) had 47-kn winds, 12-ft seas, and 41-ft swells. The NOSIRA SHARON (41°N, 51°W) found only 30-kn winds accompanied by 39-ft swells. At 0000 on the 17th the 972 mb storm was at 51°N, 59°W. There were still winds up to 50-kn and waves to 25-ft. At 1200 a new LOW had formed about 800 mi to the southeast. By the 18th the original LOW had disappeared. The new LOW curved to the northwest.

On January 15 there was a 1046-mb HIGH over the Gulf of Riga. The Azores High was 1029 mb near 35°N, 20°W. A frontal wave formed near 39°N, 35°W. At 0000 on the 16th another frontal wave was over ROMEO and brought 23-ft seas. The NAUSICAA (33°N, 14°W) measured 65-kn winds. The BISCHOFSTOR (47°N, 13°W) had 56-kn east winds. Neither reported waves. At 0000 on the 17th the two frontal waves had combined. ROMEO now had 50-kn east winds and 23-ft seas. The CENTAURE (41°N, 18°W) reported 68-kn west winds, 23-ft seas, and 33-ft swells. ROMEO had 30-ft seas at 1200. The storm crossed the coast of France on the 18th.

The CAM ILOMBA sustained damage in force 12 winds in the Bay of Biscay on the 17th. The AL AHMADIAH had weather damage on the 16th enroute to New York from Valencia. The OBOTRITA put back to Ferrol when lashings broke and hatch covers were damaged.

This was not the most severe of the storms this month but it was long-lived and one of two that managed to cross to Europe. It began as a frontal wave off Long Island on the 18th. It was caught in the zonal flow and sped eastward. It passed almost directly over the CONTRACT PIONEER at 40°N, 55°W with 48-kn winds. At 0000 on the 19th the storm was 975 mb near 43°, 46°W. A ship 90 mi south of the center had 50-kn winds. At 1200 another ship had 41-ft swells. It caught up with and absorbed two small LOWs. At this time there was 1060 mb HIGH over the North Pole. On the 20th its speed slowed and the circulation expanded. The FIRMNES (37°N, 29°W) had 40-kn winds and 36-ft swells. The AMERICAN HERITAGE (54°N, 14°W) measured 50-kn northeast winds, 20-ft seas, and 41-ft swells. The storm was over Ireland on the 21st. The storm slowly moved into Norway and finally dissipated on the 27th east of the White Sea.

These ships apparently suffered their reported weather damage during this storm; the BRESLAU, GHENT, RIO GRANDE, SENLAC, and SUNRISE.

The Midwest produced this storm. Cyclonic circulation reached the salt water on the 20th and strengthened by the 21st. By 1200 the storm consolidated into a 962 mb storm near (50°N, 62°W). There had been a few storm-force reports on the 20th, but there were many on the 21st. There were seveal over 60 kn. The VSBC (47°N, 48°W) measured 64-kn winds from the south with 15-ft seas. At 1200 on the 22d the storm was 950 mb near (53°N, 66°W). The MARTHA SHOGUN (37°N, 69°W) had 55-kn winds.

Another LOW formed 900 mi east of this center. This extended the southerly circulation as far east as LIMA. The FIRMNES (34°N, 43°W) had 44-kn south winds and 26-ft swells. A Soviet ship at 25°N, 61°W reported 43-ft swells from the northeast.

The storm was drifting northward and weakening on the 24th. Frontal waves had broken the southern part of the circulation away from the main center. The TFL FRANKLIN (36°N, 58°W) was in this circulation with 55-kn. The storm was stalled near 58°N, 62°W until the 27th when it disappeared.

A trough associated with the above LOW moved off the New England coast on the 25th and a cyclone formed over the water. The IRVING OCEAN found 53-kn winds, 12-ft seas, and 33-ft swells on the 26th. The storm was 956 mb at 49°N, 47°W on the 27th. There was a list of 35 observations with winds above 44-kn and/or waves above 24-ft. The FIRMNES (31°N, 60°W) was 1,200 mi southwest of the center with 60-kn winds and 49-ft swells. The TFL EXPRESS (37°N, 52°W) measured 68-kn winds but only reported 17-ft waves. The storm was 938 mb near 54°N, 51°W at 1200 on the 28th (fig. 28). High winds and waves continued. The Grand Banks area was particularly hard hit late in the day with five reports of over 60-kn winds and 25-to-30-ft waves. The VINLAND (46°N, 48°W) measured 72-kn winds from 240° and 30-ft seas. CHARLIE had 26-ft swells. The Grand Banks winds and waves continued into the 29th. The storm was drifting eastward on the 30th and weakening but there were still a few 50-kn winds and waves up to 30-ft. CHARLIE was still reading 20-ft

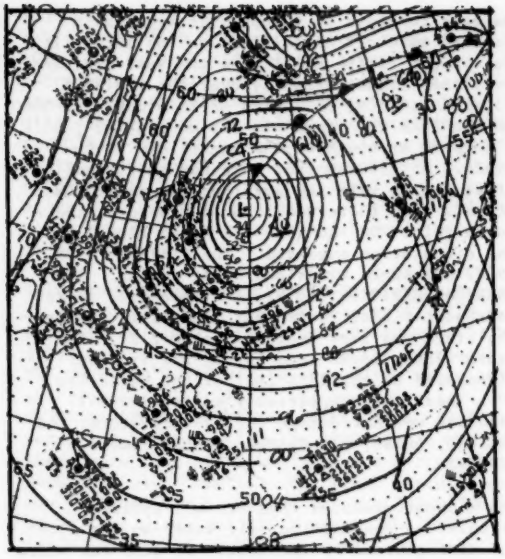


Figure 28.-- Analysis of 0000, January 29.

waves. The LOW was no longer on the 1200 analysis of February 1.

The ATLANTA reported encountering force 9 to 12 winds from the 25th to 28th and loosing the starboard anchor and 10 lengths of cable between 48°N, 07°W and 44°N, 20°W. The ARKAY also appears to have suffered damage in this storm.

Casualties -- These vessels had problems with low visibilities. The GOKTURK touched bottom in Little Bitter Lake on the 25th. The icebreaker ISBJORN grounded in ice and fog on the 20th off Dragor. The KITTANNING grounded in the Elbe Estuary on the 7th. The VELENJE hit the canal bank of the Gaillard Cut.

Extremely cold weather over Europe the first half of January resulted in many of the rivers, harbors and canals and including the sound between Denmark and Sweden were frozen over. By the third week the ice was severely hampering traffic. Up to 20 vessels were trapped in the Oresund Waterway with three Danish icebreakers working to free them. Some ice was reported to be up to 3-ft thick. Open pack ice to a depth of 30 cm was reported in the Kiel canal. These ships reported specific ice damage; BIENE, EYRARFOSS, JUPITER B. and KARLSVIK. In 1658 the 17-mi wide passage froze over allowing the Swedish King Karl Gustav to cross the ice and sack Copenhagen. The Danes were forced to relinquish a part of southern Sweden.

There was a lot of bad weather in the Mediterranean on 17th and 18th but there no high wind reports on the charts or lists of radio reports. A LOW mound over southern Greece on the 17th and 18th. A newspaper report said heavy rain and snow disrupted all forms of communication in southern and central Greece. Flights were diverted from the Athens Airport in winds reported up to force 10.

Many ships were reported as grounded, stranded, dragged anchor, and collided with other vessels. The NATALE DE GIOSA capsized and the crew was feared drowned. The 28 crewmen of the GIORGIONE abandoned ship when she was blown aground. The 8 crew of the FILITSA radioed an SOS that they were abandoning ship 2-mi offshore of Athens. The TIM STAR capsized near Alexandria. The 23 crew abandoned ship but 4 died and were missing. The following is a list of ships that had damage or were in trouble; MILAS, FORUM SKY, AEGIS PIONEER, MASIR, GIANNAKIS, NAJD II, BRYON I, ALASKA II, MARJOBIL, ZEBRINA, SAN GEORGIO REEFER, and MARENCO ALPHA.

These ships reported weather damage at unspecified times and/or position: the AL KANTARA, ANDREA, ANGELIQUE, BOCHA, BOW FORTUNE, DON FERNANDO, EL COMMODORE, EL HASHAISHI, EL TEMSAH, ELIZAS GRACE, HOMERIC DAWN, JALVALABH, KLINTE, MICHAEL DAVID, RAMSES II, SAUDIAH, and TENKO.

WEATHER LOG, FEBRUARY 1985 -- A primary storm path could be said to exist across the Great Lakes to Newfoundland to 55°N, 35°W to the Denmark Strait. Another short path existed from near 45°N, 50°W to 55°N, 25°W. There was a concentration of storm tracks between latitudes 50° and 55°N and longitudes 20° and 40°W. There were only three significant storms over Europe.

The Icelandic Low was 996 mb centered near 56°N, 32°W. This was 7 mb lower and about 300 mi southeast of it normal (fig. 29). The center of the Subtropical High was 1023 mb at 28°N, 51°W many miles west of its usual position. There was an anomalous 1024 mb High centered over Germany.

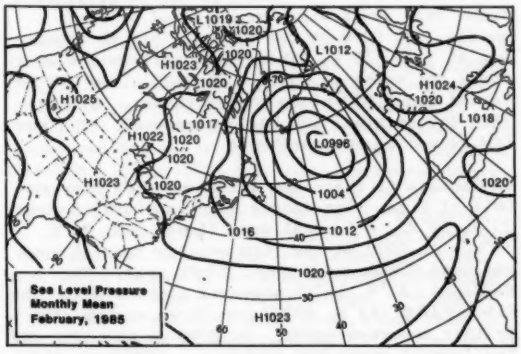


Figure 29.-- Monthly mean sea-level pressure.

There were two significant sea-level pressure anomaly centers; one was minus 11 mb near 51°N, 28°W associated with the Icelandic Low, and the other was plus 10 mb over the North Sea associated with the High over Europe. There was another plus 7 mb center over the Foxe Basin of Northern Canada. The sea-level pressure was above normal over most of North America. In fact, most of the Northern Hemisphere had above normal mean sea-level pressure except for the Icelandic Low and two minus 10 mb centers over Asia.

In the upper air at 700 mb there was an

anomalous LOW in association with the Icelandic Low. The primary center of circulation was still over Somerset Island in Northern Canada, as is normal. The flow was zonal from the eastern United States to about 40°W between 30° and 50°N. The normal slight ridge over western Europe was much sharper than normal, blocking storms from that area.

Some Climatology. On February 16, 1943 record cold prevailed over the Northeast. The temperature plunged to minus 39°F at Portland, Maine. On the 17th in 1958 the greatest snow storm of the mid-20th century struck the Northeast. There was 30 in of snow in interior New England with 19 in in 24 hr at the Boston Airport. On the 23d in 1802 another great snowstorm raged along the coast of New England. North of Boston there was a total snowfall of 48 in. Three large ships were wrecked along Cape Cod.

Extratropical Cyclones -- The month started with a normal Bermuda High and the Azores High over Spain. Frontal waves were moving northeastward along a front between the two HIGHs then eastward across Scandinavia. There were also frontal waves along the east coast of the United States. High pressure was centered over the North Pole. By midweek the Azores High had moved to over Germany. A frontal wave moved eastward across the top of the Bermuda High and deepended rapidly. By the end of the week multicentered cyclonic circulation covered the North Atlantic north of latitude 30°N.

The storm continued into the second week as new centers formed, intensified, and continued the overall circulation. At midweek the cyclone had only one center and weakening. The Azores High redeveloped in place. Another HIGH moved off Labrador. At end of the week high pressure dominated the western half of the ocean with weak low pressure centers over the eastern half.

The third week the western HIGH moved eastward and high pressure moved southward into Europe from Scandinavia. There was low pressure over the Labrador Sea and Iceland area.

The fourth week the central ocean HIGH continued moving eastward. There were frontal waves moving along a front west and northwest of the center of the HIGH. A new HIGH moved off the east coast of the United States. High pressure covered most of this ocean. At midweek the large HIGH was breaking down but high pressure still dominated Europe. At end of the week a LOW from Nova Scotia deepened into a severe storm. Another HIGH and LOW combination immediately followed the last day of the month.

On the first of the month a cold HIGH over the Plains States had pushed a cold front deep into the Gulf of Mexico. It stretched northeastward across the Southeastern States to Cape Hatteras. Waves were moving along the front. On the 2d one of these continued to deepen off Nantucket. By 1200 on the 4th the storm was 975 mb near 44°N, 43°W. The IRVING OURS POLAIRE (47°N, 56°W) had 68-kn northwest winds. The EXPORT CHALLENGER (38°N, 48°W) estimated 55-kn winds from the west with 44-ft swells. The storm was 964 mb at 1200 on the 5th near 44°N, 34°W. The ONFS (38°N, 36°W) measured 55-kn winds, 30-ft seas, and 43-ft swells. The AMERICANA (38°N, 43°W) reported 50-kn winds and 56-ft waves. The ARGONAUT (37°N, 34°W), and JOHN WULFF (35°N, 44°W) both report 39-ft swells. The RAVENSCRAIG (43°N, 43°W) had 30-ft seas and 36-ft swells. On the 6th there were many wind reports of 50-kn or greater and half a dozen of 60-kn or greater. Sea and swell reports over 30-ft were common. The DHYW (38°N, 25°W) reported 60-kn southwest winds and 49-ft seas. The LASH ATLANTICO (36°N, 37°W) reported 55-kn winds from 300°, 33-ft seas, and 49-ft swells. The JOHN WULFF and ARGONAUT were now reporting 43-ft swells.

On the analysis of 0000 on the 7th the LOW was moving due north. A new LOW had popped up near 39°N, 48°W. The old center circled south of Kap Farvel until the 10th as this new LOW became a severe storm. It appeared that these ships were involved in this storm and suffered damage. They were the ALTIS, ATLANTIC CORONA, CITY OF PERTH, and STARMAN ASIA.

This potential storm popped up on the 0000 analysis of the 7th at 39°N, 47°W. The VIKTOR BUGAYEV was almost directly at the center with 45-kn southwest winds. The SANTA SILVIA MARU (36°N, 43°W) measured 54-kn winds. In 12 hr the storm raced 660 mi to 42°N, 33°W at 972 mb. The ZIM IBERIA (37°N, 31°W) had 60-kn winds and 26-ft swells. The JOHN WULFF (36°N, 33°W) now had 57-kn winds, 12-ft seas, and 46-ft swells. The ARGONAUT had dropped to 25-ft swells.

At 1200 on the 8th the storm was at 49°N, 21°W) at 956 mb. There were high winds and waves reported all across the Altantic between approximately 30° and 50°N. The storm with its multiple centers covered all the North Atlantic north of latitude 25°N. The ROWAN-JUNEAU (44°N, 60°W) measured only 27-kn winds from 290° but reported 49-ft swells from 350°. The CANADIAN EXPLORER (48°N, 21°W) measured 65-kn winds, 26-ft seas, and 49-ft swells on the other side of the ocean. The SEA-LAND EXPRESS (50°N, 23°W) measured 58-kn winds and 30-ft seas. The storm was stationary on the 9th as another small LOW was absorbed (fig. 30). The majority of the higher winds were strong gales to violent storm and the waves were up to 33-ft but the SAM HOUSTON (35°N, 67°W) was hit by a mountainous 60-ft wave with 75-kn winds and suffered bow damage about 0600 on the 9th. The KENNETH T. DERR (44°N, 27°W) measured 45-kn winds and 33-ft seas. LIMA measured 48-kn east winds and 25-ft seas and 26-ft swells. On the 10th the LOW swung westward. The SAM HOUSTON (33°N, 64°W) now measured only 34-kn winds, 26-ft seas, and 36-ft swells. The MARCONA CONVEYOR (33°N, 45°W) and CHASTINE MAERSK (37°N, 40°W) both had 33-ft swells. On the 11th the storm was back to one primary center and weakening. The higher were in the storm category. Only one ship reported swells up to 33-ft.

On the 12th the storm was completing a loop. A German ship at 46°N, 28°W measured 47-kn winds and 33-ft seas. The ENTERPRISE (46°N, 24°W) had 41-kn winds, 17-ft seas, and 33-ft

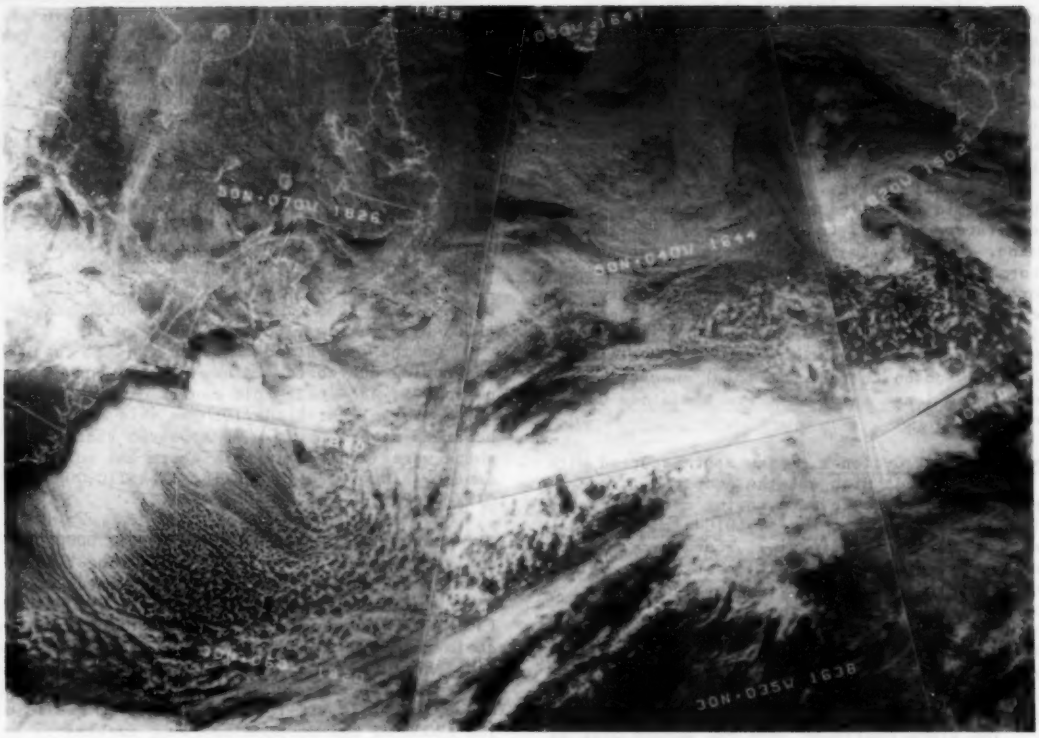


Figure 30.-- A composite of three NOAA Polar-orbiting Satellite passes showing the large storm spanning the ocean from shore to shore. The SAM HOUSTON was in the unstable flow over the Gulf Stream. NOAA.

swells. The storm was dissipating on the 14th but the RIA LUNA (43°N, 09°W) still found 33-ft swells. As best we could be determined from the information available these ships suffered their damage in this cyclone. They were the DELTAGAS, SAM HOUSTON, OBOTRITA, MOORSMAN, CORINNA, VORTIGERN, and WAVE CREST. The BUSKO ZDROJ sank near 55°N, 06°E late on the 8th after her cargo of steel shifted in heavy seas and force 7 winds. Only one crewmen of 25 was rescued.

The only time the center of this storm was over salt water was when it formed near Vancouver Island on the 7th and it dissipated over Hudson Bay on the 16th. The storm moved southeastward to Mississippi on the 11th, then northward west of the Appalachian Mountains. Only the southerly circulation was off the U.S. East Coast. On the 12th the storm was over West Virginia. The BORINQUEN (38°N, 73°W) had 50-kn south winds and 17-ft waves. The ASHLEY LYKES (33°N, 76°W) also had 50-kn winds with 17-ft seas, and 25-ft swells. The USCGC DUANE (38°N, 71°W) measured 64-kn southeast winds, 10-ft seas, and 21-ft swells. On the 13th she reported 67-kn winds from the south-southwest. There were a few storm winds on the 14th. The leaking TURRIS OCTAVA at Bermuda on the 13th had additional problems when 45-kn winds and 20-ft swells were in the area. The HARBEL TAPPER had damage on the 12th.

The second described storm left a cyclonic circulation off the west coast of Europe when it dissipated. On the 15th a LOW formed north of the Azores and west of Cape Finisterre. The SCOL CARRIER (50°N, 02°W) had 61-kn winds from the east and 17-ft waves. The SEA-LAND PIONEER (37°N, 29°W) had 50-kn winds, 20-ft seas, and 30-ft swells. On the 16th the FARLAND (43°N, 25°W) had 24-ft swells.

The storm crossed over Cape Finisterre on the 17th.

This was a long-lived storm. It formed near Death Valley, Calif. on the 20th. It moved southeastward, then northeastward and moved over Maine on the 24th. SEDCO 709 (44°N, 61°W) and two other reporters KNDH and KSCP in the same area reported 50-kn winds and waves as high as 15-ft. On moving over water the storm deepened rapidly to 967 mb at 48°N, 42°W (fig. 31). The VCNP (46°N, 49°W) measured 64-kn north winds. The AMERICAN PIONEER (37°N, 48°W) had 45-kn winds, 17-ft seas, and 33-ft swells. The SEA-LAND VOYAGER (43°N, 44°W) estimated 60-kn winds. CHARLIE measured 52-kn winds and 28-ft seas.

At 1200 on the 27th the storm was 968 mb near 55°N, 29°W. There were several reports of 60-kn winds. The DUVB (44°N, 30°W) measured 60-kn winds 38-ft seas, and 35-ft swells. The

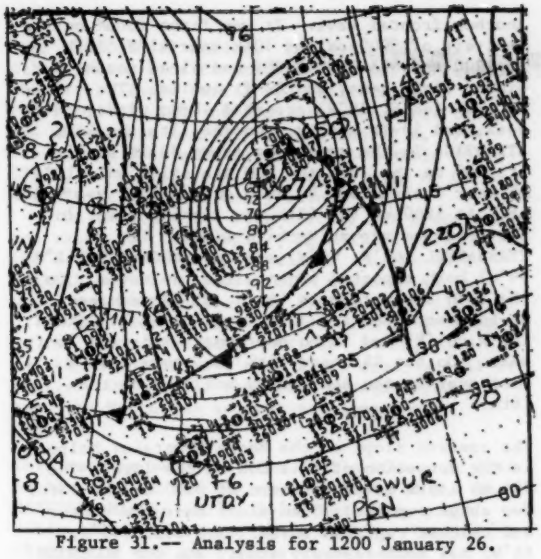


Figure 31.-- Analysis for 1200 January 26.

DART AMERICA (49°N, 18°W) had only 22-kn south winds but the swell was 30-ft. The storm dissipated by March 1 leaving only some high swell reports.

This storm was the coming together of two LOWs northeast of Cape Race on the 28th. One LOW came out of the Rocky Mountains and the other off Cape Hatteras. At 1200 on the 28th the storm was 976 mb at 50°N, 50°W. The TFL FRANKLIN (40°N, 52°W) had 55-kn winds from the southwest and 20-ft waves. The EEKLO (41°N, 47°W) measured 48-kn winds from the south, 20-ft seas, and 33-ft swells. The RAINBOW HOPE (42°N, 57°W) had 25-ft swells.

At 1200 on March 1 the storm was 970 mb near 58°N, 39°W. At 0600 CHARLIE had winds up to 48-kn and seas of 25-ft. The MANCHESTER CHALLENGE (47°N, 34°W) had 47-kn west winds, 16-ft seas, and 33-ft swells. The MINERVA (52°N, 40°W) had 60-kn west winds, 33-ft seas, and 39-ft swells. On the 2d CHARLIE had 26-ft seas and the CHALLENGE had 30-ft swells. The MAGNUS JENSEN (59°N, 47°W) had 54-kn winds with 33-ft seas. A frontal wave moved south of this LOW weakening it.

Casualties -- These vessels suffered damage in ice, mostly in the Baltic Sea; CHRISTEL, HOHEBANK, KELTIC CONFIDENCE, MALENE SLOTO, and SELKIRK SETTLER. The SOROKOS and CITY OF CAMMERAY had ice damage at Quebec, The ORIENT PIONEER had ice damage off Newfoundland. It was reported that the White Sea suffered the worst pack ice in 65 yr.

These ships had problems in fog on the 26th: the BERGFJORD and EMDEN collided on the lower Elbe, the VOLGO-BALT 238 and RIO CALCHAQUI also collided on the Elbe, the JEAN ALLEAUME went aground near Grangemouth.

These ships were involved with heavy weather on the Mediterranean: KAZAR, LINA, NAUCRATES, and SHEIKH ALI.

The ELISABETH OLDENDORFF, GEESTBAY, and SAINT SIMEON reported weather damage this month.

WEATHER LOG, MARCH 1985 -- This was a busy month for cyclones over the North Atlantic but most were not very severe. There were two primary storm paths. One originated over the Northern Plains States of the United States, moved over the Grat Lakes and across the maritime provinces of Canada, then northeastward toward the Denmark Strait. The second path was from Cape Hatteras east-northeastward to near 40°N, 50°W, then northeastward to the Denmark Strait also. Several storms tracked over western Europe, mostly the last half of the month. The paths approximated climatology except they were more easterly over the western ocean.

The overall monthly mean sea-level pressure pattern was near the climatic pattern except for pressure values (fig. 32). The Icelandic Low was 999 mb near 56°N, 48°W, 6 mb lower than normal and about 300 mi southwest of its usual location. A secondary 1007 mb LOW near 68°N, 02°E was about 300 mi south of its normal position. The Azores High was 1025 mb near 36°N, 26°W. This was 5 mb higher than normal and 700 mi to the northeast.

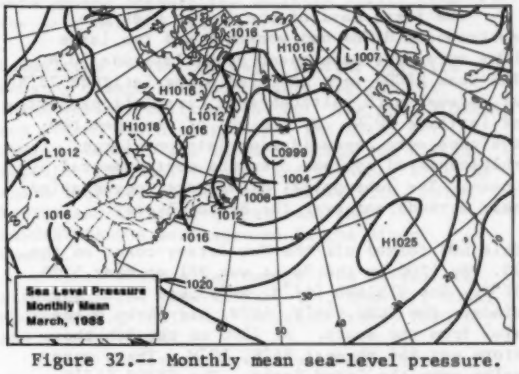


Figure 32.-- Monthly mean sea-level pressure.

The Icelandic Low produced a negative 8 mb anomaly center near 56°N, 52°W. There was another minus 3 mb anomaly center near Rotterdam and the negative area covered the Norwegian Sea, United Kingdom, France, Germany, and Italy. The zero isoline made an arc from Nova Scotia to 50°N, 35°W to Iceland than from Iceland south, west of Ireland to Brest France.

The upper air flow at 700 mb was zonal between 30°N, 50°N, latitude from the East Coast to about 50°W longitude, then northeasterly over a ridge off western Europe. There was an anomalous LOW near 57°N, 55°W).

Some Climatology. On March 5, 1962 a tremendous storm raged along the Atlantic coast. Winds along the Middle Atlantic coast reached 70 mi/hr and raised 40-ft waves. On the 6th in 1872 a cold wave hit the East Coast sending the mercury to -8°F at Boston. It was the most severe cold wave in modern history. On the 12th in 1888 a storm struck southern New England. The storm produced 58 in of snow at Saratoga, NY

and 50 in at Middletown Conn. The snow and cold resulted in 400 deaths.

Extratropical Cyclones -- The month started with a severe storm south of Kap Farvel that is described in the February Weather Log. High pressure was south of approximately 50°N. At midweek there was a strong Azores High and another storm over the Labrador Sea. At the end of the week another storm was moving out of New England.

The first of the second week a large 1043 mb HIGH was moving eastward off Cape Cod. The Azores High was moving northeastward over Europe. A LOW had developed over the Mediterranean. At midweek a 1044 mb HIGH was over Ireland with weak circulations over the north and western ocean. The end of the week a strong HIGH was over the central ocean with LOWs over the Maritime Provinces and Scandinavia.

There was a deep LOW over the Labrador Sea the beginning of the third week. The middle of the week found a normal pressure configuration - An Azores High, LOWs U.S. East Coast and near Kap Farvel, and LOW central Europe. There were both Bermuda and Azores high pressure cells at the end of the week with an intense HIGH north of Moscow. LOWs were confined to the northern latitudes.

The first days of the fourth week the subtropical HIGHs had weakened and two large LOWs were near each coast along latitude 50°N. The weak HIGHs were centered along latitude 25°N at midweek with multicentered circulations north of latitude 30°N. By the end of the week the cyclones were consolidating into one large multicentered cyclone over the north-central ocean. The subtropical HIGHs were regenerating near Bermuda and over the Bay of Biscay.

This LOW formed off the New Jersey coast on the 2d. By 1200 on the 3d it was 981 mb near 51°N, 57°W. The VINLAND (47°N, 54°W) had 60-kn south winds. The VCNP (46°N, 50°W) had 54-kn winds also from the south. At 1200 on the 4th the storm was 964 mb near 56°N, 50°W. There were gales over the Grand Banks. The CRYOS (47°N, 56°W) had 55-kn west winds. CHARLIE measured 18-ft seas. They were 23-ft on the 5th. The OVERSEAS ARGONAUT (46°N, 41°W) found 55-kn winds, 16-ft seas, and 25-ft swells. The CONTRACT MERCHANT (42°N, 38°W) had 51-kn winds. CHARLIE measured 23-ft swells. The REY JRS II had 20-ft swells. This LOW dissipated on the 6th and another formed over Kap Farvel.

This fast moving LOW came into existence on the 5th over New England. On the 6th it was bringing gales and 20-ft waves to the Grand Banks. The CMB EUROPE (46°N, 38°W) had 45-kn winds and 21-ft seas. The 974 mb storm passed about 90 mi north of CHARLIE at 0000 on the 7th. The STARMAN ASIA (46°N, 34°W) had 50-kn south winds and 20-ft seas in the warm sector. LIMA had 46-kn south winds and 16-ft seas. The higher winds and waves were along the front. On the 8th the storm was over the Denmark Strait. A RIGG at 61°N, 02°E measured 48-kn south winds. The storm curved southwestward and quickly disappeared.

Another frontal wave. It was first found on the analysis of 0000 on the 10th near 41°N, 50°W. At 1200 the SEA-LAND PACER had 41-kn south winds, 15-ft seas, and 20-ft swells. The MALAHAT (46°N, 39°W) reported 48-kn winds, 20-ft seas, and 23-ft swells. On the 11th the DART ATLANTICA In the same area found 30-ft swells. At 1200 on the 12th the LOW was still only 1000 mb near Iceland but by 0000 on the 13th was 990 mb. At 1800 on the 12th the fishing fleet in the area was reporting high winds. The HYASSAFELL (62°N, 08°W) and the SKOGAFOSS (62°N, 09°W) both reported 60-kn winds, no waves. On the 13th a platform at (61°N, 01°E) measured 45-kn west winds and 30-ft seas. The LA CHACRA (62°N, 01°E) had 50-kn northwest winds and 36-ft seas. On the 14th and 15th the storm made a loop over Sweden and Norway and died on the 16th.

The eastern slope of the Rocky Mountains helped in the formation of this LOW on the 10th. The 986 mb storm moved offshore at 0000 on the 13th. Two ships reported 75-kn winds near the center and neither reported waves. The CG26 (43°N, 66°W) had southeasterly winds, and the BLUENOSE (44°N, 68°W) had northerly winds. Other ships were reporting gales. The KNDH (44°N, 60°W) reported 51-kn east winds and the DYUI SKAGERAK (40°N, 64°W) measured 48-kn winds with 23-ft seas and 25-ft swells. On the 14th the KMHF (45°N, 58°W) measured 48-kn southeast winds and 15-ft seas. At 1200 on the 15th the 972 mb storm was near 52°N, 54°W. On the 16th this was a large 966 mb storm but there were few high wind and wave reports (fig. 33). The FERNGOLF (40°N, 58°W) had 40-kn winds with 30-ft waves. On the 17th the IRVING ESKIMO (49°N, 65°W) had 52-kn west winds and 23-ft seas. On the 18th another LOW east of Kap Farvel took over the circulation.

This was a double LOW cyclone for the first days of its existence. Waves were forming on a front

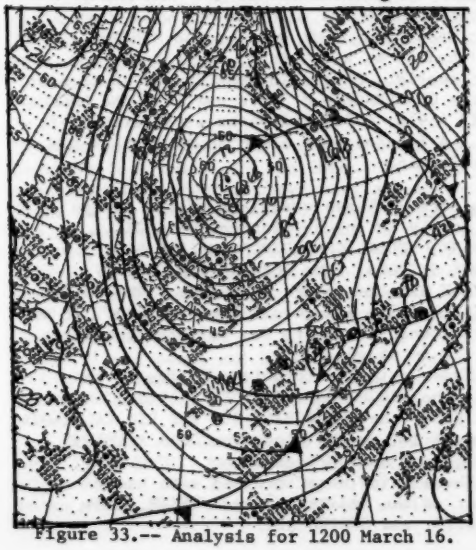


Figure 33.-- Analysis for 1200 March 16.

over the Gulf of Mexico. Two followed each other across Florida and over the Gulf Stream on the 17th. There were a few isolated gales reported. At 1200 on the 18th there were two 984 mb centers near 39°N, 63°W and 44°N, 57°W. There were many gale reports. The AMELIA TOPIC (39°N, 60°W) reported the highest wind of 60-kn with 26-ft seas and heavy rain.

On the 19th the northeastern LOW broke away and raced northeastward. The DART BRITAIN (46°N, 34°W) found 45-kn winds. On the 20th CHARLIE had 21-ft seas. LIMA measured 41-kn winds and 20-ft seas. The SINBAD SAXON (59°N, 02°E) had easterly 50-kn winds with 21-ft seas on the 21st. The DART AMERICANA (49°N, 13°W) had 40-kn northwest winds, 23-ft seas, and 41-ft swells. On the 22d the storm turned northward over the North Sea and was not longer of concern.

This was the second of the double LOWs. At 1200 on the 18th it was 982 mb near 38°N, 64°W. The MATHILDE MAERSK (40°N, 55°W) had 50-kn south winds, 10-ft seas, and 30-ft swells. On the 19th there were gale-force winds. The LOOSDRECHT (42°N, 50°W) had 41-kn south winds, 23-ft seas, and 26-ft swells. The FNDV (41°N, 58°W) measured 48-kn winds and 33-ft seas. On the 20th the winds were 50-kn with 13-ft seas and 44-ft swells. The KFPN (44°N, 60°W) measured 63-kn north winds and 25-ft seas. The storm disappeared on the 21st.

A combination of two primary LOWs produced this storm. There were other small LOWs involved as the storm evolved. The first LOW was first analyzed over North Carolina on the 23d. It moved slowly eastward with little development. On the 25th another LOW formed northeast of this one. On the 26th there were two 979 mb centers at 43°N, 44°W and 47°N, 43°W. A SHIP (40°N, 44°W) had 49-kn winds, 30-ft seas, and 26-ft swells. On the 27th the northeastern center was turning northwestward to dissipate. CHARLIE had 23-ft seas (fig. 34). Three ships in the vicinity of 38°N, 62°W reported winds between 40 and 52 kn and waves between 16 and 25-ft. On the 28th the storm was 978 mb near 41°N, 41°W. The NICHIRIN MARU (35°N, 41°W) reported 56-kn west winds, 20-ft seas, and 21-ft swells. A ship closer to the center had 48-kn winds and another ship 23-ft seas and swells. At 1200 on the 29th the storm was 972 mb near 49°N, 28°W. The KUNUNGUAK (49°N, 45°W) had northeasterly 48-kn winds and 25-ft seas. LIMA measured 48-kn east winds, 21-ft seas, and 25-ft swells. ROMEO had 20-ft seas on the 30th and the NIVI ITTUK AT 59°N, 44°W reported 60-kn winds from the northeast and 23-ft seas.

Another LOW developed west of this center on the 30th and on the 31st two frontal waves were moving through the southern circulation. The original LOW disappeared.

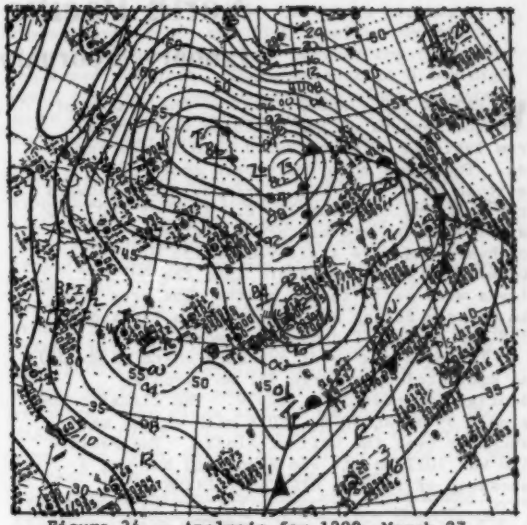


Figure 34.— Analysis for 1200, March 27.

Casualties -- The two major weather culprits causing damage this month were fog and ice. These vessels collided in fog: the ARGO PIONEER and CYRANO which sank, ESRAM and MURAT BEY, GUSTAV BEHRMANN and RHINSEE, HUNGA and MINERAL ALEGRIA, CONTRACT VOYAGER and VITOSHA, AUTOLINE and a trawler, ADRIANA and ARKLOW VIEW, DUTCH MASTER and ABERTHAW FISHER, and the LANCASTERBROOK went aground in the River Humber.

These vessels had damage from encounters with ice: the IRAN MEYSAM, IVI, LARA S., MOLAT, NICHOLAS H., PAMIT C., SOUTHERN CROSS, TOXOTIS, and VISHVA VIKRAM.

Four fisherman adrift for 2 days after abandoning the trawler CHRISTINA 1 were rescued by the tug TAURUS on March 3. High seas flooded the engine room and knocked out her power.

These ships reported weather damage: BARBARA LEONHARDT, FESTIVALE, F P CARRIER, LAURENTIAN FOREST, PASSERO, and TIBESTI. The tug JOHN A. DOWNS capsized and sank in Long Island Sound on the 4th in stormy waters. The 13 crew members on the tug and barges were rescued by the U.S. Coast Guard.

These ships suffered weather damage during the last week of the month: AGIO MATTHEOS, KAVO PEIRATIS, MARIWOOD, MONTERREY, PIRATA, and yacht SILENCE (sank with four persons aboard).

North Pacific Weather Log

January, February and March 1985

WEATHER LOG, JANUARY 1985 -- The tracks of the centers of the cyclones were spread from latitude 30°N northward into the Bering Sea. There was no primary path south of latitude 40°N. The was a primary path eastward from Hokkaido to about 170°E. East of 180° the majority of the storms curved northeast to northward and were scattered to 135°W. Those storms that moved northward into the Gulf of Alaska were early in the month. The area over the eastern Bering Sea and south to latitude 45°N was a maze of crossing tracks.

The mean sea-level pressure chart (fig. 35) was dominated by a large 981 mb circular Aleutian Low near 51°N, 176°W. The climatic Low is only 99 mb at 50°N, 170°E with a 1005 mb subcenter over the Gulf of Alaska. The Pacific High was 1022 mb off San Francisco but was a subcenter of 1030 mb HIGH over Idaho.

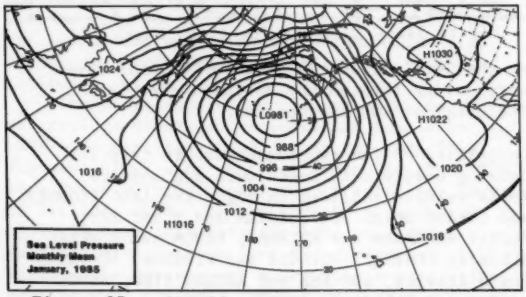


Figure 35.-- Monthly mean sea-level pressure.

There were only two significant pressure anomaly centers, one was minus 22 mb near 53°N, 175°W and the other was plus 10 mb over Idaho and the southeast corner of British Columbia. The zero isoline approximately paralleled longitude 140°W from latitude 30°N to Yakutat, Alaska where it sharply turned eastward. On the west the zero isoline approximately paralleled longitude 150°E from latitude 30°N to 60°N.

The center of circulation at 700 mb was near 51°N, 180° many miles east of its climatic center over the Sea of Okkotsk. The wind flow was zonal between Japan and 170°W between latitudes 20°N to 40°N. At 170°W the flow turned sharply northeastward than northward as it moved over a sharp ridge along the North American coast. The gradient along 180° between latitudes 20°N and 50°N was 522 meters verse the climatic 340 meters.

Tropical storms Elsie and Fabian formed over the western ocean this month.

Some Climatology -- On January 6, 1880 Seattle suffered their worst snowstorm ever when 4-ft covered the ground. Hundreds of buildings were destroyed and transportation came to a standstill. On the 29th, 1921 an intense wind storm hit the Pacific Northwest. Vast expanses of trees were blown down, 8 billion board feet. At North Head, Washington the winds reached 113 mi/hr.

Extratropical Cyclones -- The new year started out with a large cyclone centered over the Bering Sea and a 1050 mb HIGH over southern British Columbia. By the middle of the first week a severe LOW had formed in the southern periphery of the cyclone. The HIGH was drifting southward. By the end of the week another deep LOW (940 mb) had become the primary cyclonic circulation. High pressure still dominated the North American West Coast. Tropical storm Elsie formed.

This latter cyclone dominated the ocean from the Kurile Islands to Vancouver inland and south to 25°N the beginning of the second week. The HIGH moved eastward to Lake Winnipeg, Canada. Tropical storm Fabian formed near Yap Island. At the end of the week the cyclone broke into multiple centers with high pressure now over Idaho.

A large multicentered cyclone was forming on the 15th. High pressure was centered over Washington State. By midweek there were high winds and waves along the mid latitudes especially the southwest quadrant. By the end of the week the cyclone was a large single centered LOW over the Aleutians.

On the 22d a strong LOW was east of Hokkaido. Two frontal waves were moving northward off the North American West Coast. At midweek the LOW over the western ocean broke into two centers and the Pacific High built north off Portland. The LOWs temporarily weakened but by the end of the weak consolidated into a strong LOW centered near Adak. At the end of the month there was a strong Pacific High west of Cape Flattery, another near midocean (30°N, 180°), and weak LOWs north and west of the HIGHs.

The first severe storm formed in a trough east of Tokyo on the 2d as cold Asian air moved over the Kuroshio Current. There were strong winds and high waves almost immediately. The NICHIRIN MARU (36°N, 158°E) measured 60-kn west winds and

Figure 36.-- Second Officer Adrian Carvalho stands under the 9 cm (3.5 in) of ice that accumulated on the BUNGA KEISDANG.

30-ft swells. The BUNGA KESIDANG (48°N, 149°E) on the northwestern edge of the storm had 9 cm of ice from spray build up on the ship (fig. 36). On the 3d the NORTHERN HIGHWAY (35°N, 168°E) measured 53-kn winds with 33-ft seas and swells. Later in the day the VAN HAWK measured 65-kn north winds. There were several reports of winds above 50-kn and waves over 25-ft on the 4th. At 0000 the storm was 968 mb near 44°N, 173°W. On the 5th the wind was not so strong but there were many reports of high seas and swells. The storm deteriorated rapidly on the 6th as it moved into the Gulf of Alaska and against high pressure.

This frontal wave developed on the 3d very near where the previous storm formed. On the 5th there were winds of 50-kn and many waves over 20-ft. The JDSJ (51°N, 173°W) was northeast of the center with only 19-kn 110° winds but the swell was 41-ft from 090°. By 0000 on the 6th the storm was 964 mb near 46°N, 177°W. Storm-force winds and waves up to 33-ft continued. At 0000 on the 7th the storm was 948 mb near Atka Island (fig. 37). The TOKEI MARU (53°N, 175°E) measured 47-kn northwest winds, 23-ft seas, and 39-ft swells. At 1200 the pressure was 940 mb. Deeper than many typhoons and many times larger. The cyclonic circulation stretched from British Columbia to Sakhalin Island and south to latitude 25°N. The TOKEI MARU (49°N, 170°E) now had 41-ft swells on the 8th. The higher winds were mostly in the gale to strong gale category and highest waves 26-ft on the 9th. The center had turned westward on the 7th and then southward around to eastward on the 10th.

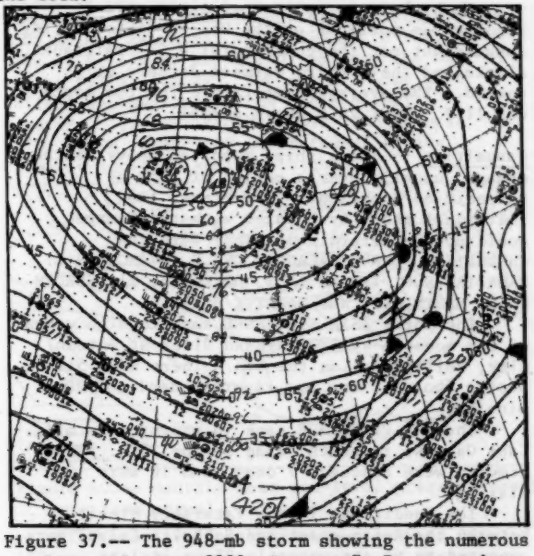


Figure 37.-- The 948-mb storm showing the numerous observations at 0000, January 7. In comparison there were only nine observations plotted on the 1200 chart of the 6th for the same area.

The storm was still large on the 10th but was filling and a small LOW moved northward through the eastern quadrant. The CHEVRON MISSISSIPPI (55°N, 139°W) had 40-kn southeast winds, 13-ft seas, and 33-ft swells. On the 11th the higher winds were between the front and the Canadian coast. There were still a few high swell reports. Some storm-force winds and waves up to 30-ft continued through the 13th. The LOW was completely gone on the 15th.

The western half of the ocean east of Japan supported four weak low-pressure centers on the 12th. There was also a LOW over the Sea of Japan and the tropical depression left from tropical storm Fabian was still near Yap Island. A LOW near 30°N, 155°E became caught in the upper air zonal flow and raced eastward at an average speed of 40-kn. On the 13th the CHARLES LYKES (30°N, 175°E) had 50-kn west winds. The BEAUTEOUS (27°N, 165°W) measured 53-kn south winds, 26-ft seas, and 28-ft swells. She reported 70-kn winds at 0300 on the 14th. The MAASSLUIS (27°N, 172°W) reported 63-kn northwest winds and 39-ft seas. At 1200 the storm was 969 mb near 33°N, 158°W and turned sharply northward. Most of the high winds and waves remained to the south. On the 15th the CONDORA (39°N, 147°W) had only 36-kn south winds with 33-ft swell. The MANULANI had 26-ft swells.

By 0000 on the 16th the storm had raced to 54°N, 150°W at 970 mb. The NEWARK north of the storm had 48-kn northeast winds. The SOHIO RESOLUTE had 45-kn southwest winds, 25-ft seas, and 33-ft swells. A sharp trough trailed southward from the storm and two ships reported waves over 25-ft near 28°N. By the end of the day the circulation had been absorbed by a larger system.

This storm caused some severe weather near the Hawaiian Islands on the 13th and 14th. Three barges were blown aground at Waianae Inlet. The CANADIAN BULKER (29°N, 161°W) had a cargo hatch damaged by shipping seas. The KETA LAGOON diverted to Honolulu as port of refuge for repairs.

This storm had several centers over its lifetime. The first LOW came out of Korea on the 11th. On the 13th it moved across the Kurile Islands. There were a few storm force winds and one report of 30-ft swells. The NORMAN AMSTEL (41°N, 146°E) found 58-kn west winds and 41-ft seas. On the 14th there were three other centers in the overall circulation. The NORMAN AMSTEL now reported 52-kn winds and 39-ft seas. Several other ships had waves about 25-ft. On the 15th another LOW center formed that was destined to consolidate the circulation around one center. The EVER LAUREL (41°N, 157°E) report read 68-kn but the 7-ft seas and 17-ft swells did not support that speed very well. The WAKAUME MARU at 30°N, 151°E measured 30-kn west winds, 13-ft seas, and high 49-ft swells.

At 0000 on the 16th the storm was 948 mb near 50°N, 175°E (fig. 38). The NELSON MARU (38°N, 170°E) measured 50-kn west winds, 13-ft seas, and 39-ft swells. The SHINKASHU MARU (39°N, 171°W) reported measuring 77-kn winds from 290° and 33-ft seas and swells. The SEA-LAND FREEDOM (40°N, 179°W) had only 50-kn

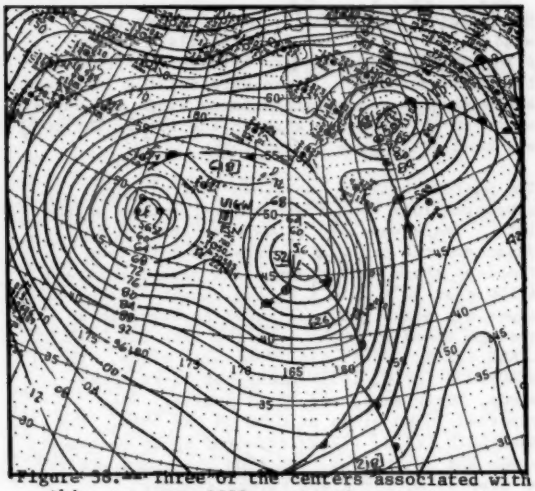


Figure 38. -- Three of the centers associated with this storm, at 1200 on the 16th. Notice the difference in the number of observations compared with figure 37.

winds but the swells were also 33-ft. On the 16th a new LOW formed in the southeast quadrant of this storm. Late on the 17th the new LOW took over the circulation. There wee many storm-force winds and high swell reports. The NELSON MARU (38°N, 176°E) measured 48-kn winds, 17-ft seas, and 36-ft swells. The SEA-LAND FREEDOM (41°N, 176°W) measured 50-kn west winds, 13-ft seas, adn 39-ft swells.

On the 17th a LOW from the Sea of Japan entered the western part of circulation. On the 18th the original storm was over the Bering Sea with light winds but there were still swell reports over 25-ft.

This LOW formed over Mongolia. On the 15th it was over the Sea of Japan. On the 16th there were some storm force winds south of the center. The storm was moving eastward. Strong gales and high swells continued into the 17th. The SKOUBORD (37°N, 156°E) measured 49-kn winds. The FORT FRONTENAC (42°N, 148°E) measured 44-kn west winds, 10-ft seas, and 33-ft swells. The INDUS MARU (34°N, 169°E) measured 56-kn winds from the northwest and 23-ft swells on the 18th. The SEA-LAND PATRIOT (37°N, 160°E) measured 50-kn winds and 26-ft swells. At 0000 on the 19th the storm was 956 mb near 49°N, 179°W. The SOHIO RESOLUTE (41°N, 152°W) had southerly 65-kn winds, 17-ft seas, and 33-ft swells. The SEALAND PATRIOT (37°N, 171°E) measured 64-kn winds, 10-ft seas, and 33-ft swells.

At 0000 on the 20th the storm was 955 mb near 51°N, 168°W and covered the northern part of the ocean. The ARCTIC TOKYO (54°N, 168°W) measured 65-kn winds from the east. The HOJIN MARU way south at 25°N, 175°E had only 5-kn winds but 36-ft swell from 320° reached her. There were a lot of swell reports near 20-ft. At 1200 a ship registered 956 mb on the barometer very near the storm center. On the 21st the highest winds reported were gale are less and even the swells had died down. The storm was deteriorating rapidly.

The warm water east of Tokyo helped the development of this storm. At 0000 on the 22d it was 976 mb about 600 mi east of Hokkaido. The EVER VALIANT (35°N, 149°E) measured 38-kn winds and 33-ft swells. The BARBAROSSA (40°N, 152°E) had 55-kn winds, 26-ft seas, and 33-ft swells. There were storm-force winds on the 23d. A second center developed to the east. The QUATSINO SOUND (40°N, 167°E) measured 58-kn west winds and 33-ft seas. On the 24th the MAERSK WAVE (45°N, 151°E) measured 45-kn winds and 31-ft seas. The ASIA MARU (41°N, 166°E) measured 50-kn winds and 23-ft swells on the 25th. At 0000 on the 26th the storm was 972 mb and had moved to only 44°N, 177°E. There were several reports of winds of 50-kn or greater and waves over 20-ft. The SEA-LAND EXPLORER was one of them with 50-kn and 33-ft seas. Other ships reporting were the LUNA MAERSK, RIGOLETTO, and MELBOURNE HIGHWAY. On the 27th this LOW dissipated and the eastern center took over. The CHARLOTTE MAERSK (32°N, 162°E) had 41-kn winds with 36-ft waves. At 0000 on the 28th the storm was 973 mb at 53°N, 180°. The PRESIDENT TYLER (38°N, 164°E) measured 40-kn northwest winds, 12-ft seas, and 26-ft swells. There were waves over 20-ft southwest and east of the center. On the 29th this center disappeared as another took over. The cyclone was rapidly breaking up. The NOAA ship MILLER FREEMAN measured 49-kn winds with 15-ft seas. The LEISE MAERSK (54°N, 164°W) had 48-kn south winds on the 30th and 30-ft seas. The PRESIDENT LINCOLN (54°N, 160°W) had 20-ft seas, and 30-ft swells.

Much above normal temperatures were reported in portions of the United States during January but not the continental U.S. Fairbanks, Alaska had their third warmest January on record. The average temperature for the month was 11°F, about 24°F above normal.

Casualties -- These ships reported heavy weather damage, usually over a period of time at unspecified locations. Therefore, the individual storm associated with the damage could not be determined. They were the CHELSFIELD, CHRYSOVALANDOU GRACE, EVANGELOS L. HAWAIIAN SUN, ISLAND LADY, HOKKO No. 21, KUROSE No.3, MARINICKI, and NANETTE STAR.

The ferry ASIA SINGAPORE sank in high waves on the monsoon-swollen Agusan River at Butuan City, Philippines on the 6th. There were 512 people aboard. One was reported dead and 20 missing.

The HWA PYUNG ACE sank in stormy seas off Cape Osezaki in south Japan on the 29th. Three crewmen were rescued, 7 dead, and 10 were missing.

Ice conditions in the Tatarskiy Strait between the Asian coast and Sakhalin Island were reported to be the worse in 25 yr in late January. It was reported that dozens of vessels were trapped in the ice. Three icebreakers were trying break them out.

Other Casualties -- The BOTANY BAY

encountered heavy weather over the Tasman Sea. Newspaper reels broke loose in the hold.

WEATHER LOG, FEBRUARY 1985, NORTH PACIFIC

EATHER LOG, FEBRUARY 1985 -- There were fewer significant extratropical cyclones over the North Pacific this month than I can remember in my 12 yr of writing the Weather Logs. This was reflected in the mean sea-level pressure. The storm tracks over the western ocean criss-crossed without any specific pattern tracking from eastward to northward. The storms that crossed northeastward over the Date Line continued a general path along the Alaska Peninsula. One storm that formed near 30°N, 160°W tracked northwestward. Another storm formed in the area 3 days later and tracked northeastward into the Gulf of Alaska. Two storms formed north of latitude 75°N.

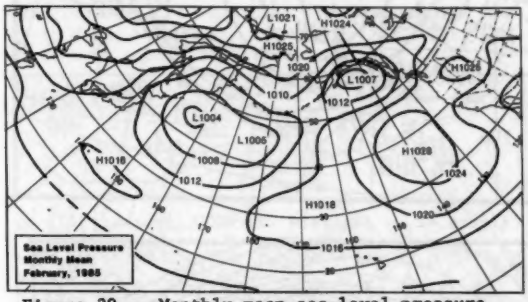


Figure 39.-- Monthly mean sea-level pressure.

The monthly mean sea-level pressure chart reflected the sparsity of cyclones (fig. 39). There were three weak low-pressure centers; one 1004 mb off Hakkaido (43°N, 155°E), a 1005 mb near 43°N, 174°E, and a 1007 mb over the Gulf of Alaska (57°N, 145°W). The western Lows were shifted southwestward from their normal location. The Pacific High was 1028 mb near 38°N, 139°W, about 600 mi northwest of its climatic location and 8 mb higher.

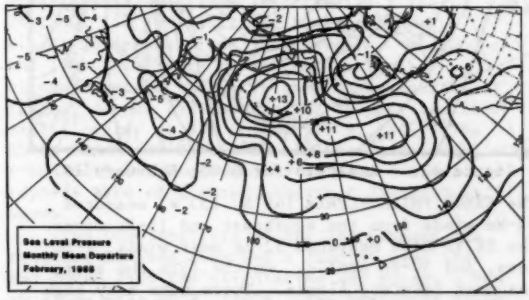


Figure 40.— Monthly mean sea-level pressure departure from normal.

The sea-level pressure anomaly chart (fig. 40) was positive over a large area of the northern and eastern ocean. The zero isoline approximated latitude 20°N from the Mexican Coast to near Hawaii, then northwestward to Sakhalin Island. There were three large positive anomaly centers, plus 13 mb near 57°N, 180°, two plus 11 mb centers near 49°N, 160°W and 45°N, 142°W. The only significant negative center was 5 mb near the eastern tip of Hokkaido.

The 700 mb upper airflow was zonal between latitudes 20°N and 40°N between the Asian Coast to longitude 180°. The center of circulation was over the Kurile Islands higher than climatology. There was an anomalous closed High near 30°N, 140°W. This produced an amplified ridge that stretched northwestward into the Bering Sea. There was a trough over Alaska and slight ridging over the Rocky Mountains as usual.

Some Climatology. On February 4, 1887 San Francisco received 4 in of snow and the hills to the west 7 in. On the 10 in 1978 as much as 8 in of rain fell in southern California with widespread flooding and mudslides. On the 25th of 1922 Los Angeles soared to 92°F, a February record.

Extratropical Cyclones -- This month began with a large Pacific High adn several other high-pressure center across the subtropics. LOWs were confined to the northwest ocean. At midweek the Pacific High was retreating southward. A HIGH from the central ocean was tracking northeastward. At end of the week there was high pressure over the northern ocean, a LOW over the Gulf of Alaska and several others over the midlatitudes.

The second week there was a 1048 mb HIGH over the Bering Sea. South of the HIGH the pressure pattern was cut up by many centers. At midweek a severe LOW was development east of northern Japan and another over the Gulf of Alaska. A tongue of high pressure had pushed southward from the Bering Strait by the end of the week separating the two LOWs.

The Pacific High was redeveloping the third week with high pressure over the Chukchi Sea. At midweek the Pacific High was centered on latitude 45°N. There was an intense HIGH over Asia with a 1060 mb subcenter on the northeast coast of Siberia which ridged eastward to the Yukon. LOWs were confined to a northeast-southwest band between the large HIGHs. A large LOW developed over the central ocean. At end of the week the high pressure over the north had weakened but the Pacific High strengthened.

The fourth week another large LOW formed over Japan. The Asian High was strengthening again. There was a deep LOW over the Arctic Ocean near 80°N, 150°E. At midweek a LOW east of Japan and the Pacific High were the only significant pressure systems over this ocean. At the end of the month the Pacific High was holding steadfast in the vicinity of 40°N, 140°W. There was weak cyclonic circulation over the northern ocean.

The first storm of the month actually was first analyzed at 1200 January 30, near 40°N, 160°E but did not become significant until February. At 0000 on February 1 it was 968 mb near 53°N, 179°E. The HOEGH MIRANDA (54°N, 168°W) measured 50-kn southeast winds and 20-ft seas. The TOYOTA MARU No. 24 (45°N, 172°W) had 27-kn with 26-ft swells. At 1200 the PACIFIC TRADER (54°N, 178°W) was within 30 mi of the center of the storm with a sea-level pressure of 959 mb. On

the 2d the HARBOUR BRIDGE (55°N, 180°) measured 50-kn winds, 23-ft seas, and 25-ft swells. A Korean ship near 52°N, 169°E had 50-kn winds and 18-ft waves. As the storm moved northward over eastern Siberia it dissipated.

The 1200 analysis of the 3d indicated two new weak LOWs over the western ocean. One was over the eastern tip of Hokkaido and the other to the south near 33°N, 152°E. The northern LOW developed quickly. At 0000 on the 4th Ostrov Urup measured 50-kn winds. The IRIS ISLAND (40°N, 158°E) had only 30-kn winds but reported 31-ft seas and 25-ft swells.

By the 5th the two LOW s were in one cyclonic circulation. One LOW was near 55°N, 155°E at 978 mb and the other 980 mb near 48°N, 168°E. The MAYASAN MARU (53°N, 171°E) measured 57-kn east winds, 13-ft seas, and 33-ft swells. The SEISHIN MARU (53°N, 169°E) had 62-kn winds from 120° and 30-ft seas. By 1200 the analysis showed the systems had combined into one LOW. The storm was over Kamchatka on the 6th. The MAYASAN MARU now had 44-kn southwest winds, 17-ft seas, and 30-ft swells. The DAIHO MARU (52°N, 170°E) estimated 62-kn winds and only 17-ft waves. On the 7th the storm had tracked westward into Siberia.

The original LOW associated with this storm formed over the East China Sea on the 8th. As the circulation moved over Japan on the 9th and 10th the circulation broke into three centers. A new center east of Tokyo became the primary center. The PLANTIN (45°N, 150°E) reported 58-kn winds. The PRESIDENT JOHNSON (42°N, 148°E) had 40-kn east winds, 15-ft seas, and 30-ft swells. There were many storm-force winds on the 11th. The PRESIDENT EISENHOWER (40°N, 144°E) measured 27-kn northwest winds, 7-ft seas, with 25-ft swells. The SEA-LAND LIBERATOR (37°N, 154°E) measured 61-kn west winds, 26-ft seas, and 23-ft swells.

At 0000 on the 12th, the storm was 972 mb near 46°N, 155°E. The TAKASAGO (43°N, 152°E) had 48-kn west winds, 30-ft seas and 43-ft swells. The EASTERN ROYAL (45°N, 153°E) measured 47-kn winds, 26-ft seas, and 18-ft swells. The storm moved over the Sea of Okhotsk on the 12th and started to weaken rapidly.

On the 12th there were Tehuantepecer winds over the Gulf of Tehuantepec. A 1031 mb HIGH was centered near Brownsville, Texas. Strong winds poured down the south side of the mountains of the Isthmus (fig. 41). The JINMU MARU (15°N, 96°W) measured 48-kn north winds and 17-ft seas and swells. The ASIAN HIGHWAY (14°N, 96°W) measured 49-kn northeast winds with only 7-ft seas.

This LOW was first analyzed on the 1800 chart of the 12th near 39°N, 154°W. There was already a weak cyclonic circulation in the area associated with an upper-air cut-off LOW. By the 14th the upper-air LOW had moved northward and became the primary upper-air LOW. On the 13th the SHELDON LYKES (34°N, 165°W) had 48-kn north winds and 25-ft swells. At 0000 on the 14th the 970 mb storm was centered near 53°N, 143°W, (fig. 42).

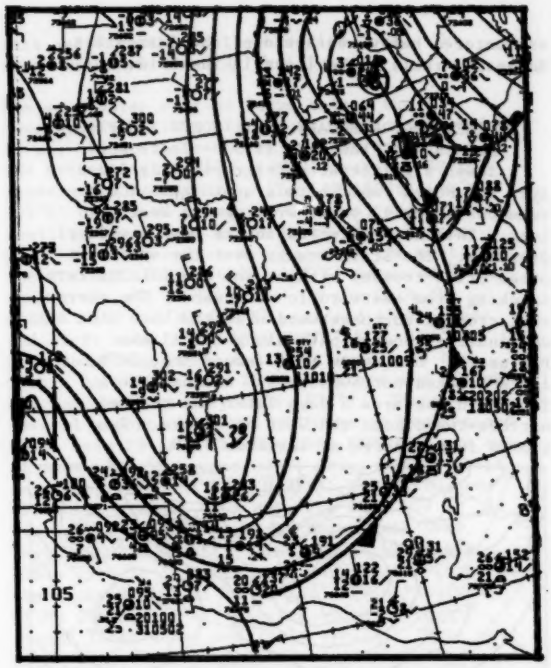


Figure 41.-- Analysis for 0000, February 12.

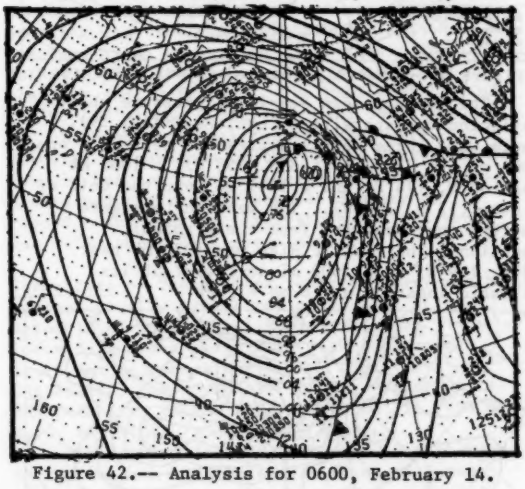


Figure 42.-- Analysis for 0600, February 14.

The EXXON PHILADELPHIA (49°N, 133°W) measured 52-kn winds from the southeast and 15-ft waves. The SEIYO MARU measured 52-kn west winds, 7-ft seas, and 30-ft swells. On the 15th the storm was near Yakutat, Alaska. There were many high wind and wave reports. The SEIYO MARU now at 50°N, 137°W now had 39-ft swells. The CHIKUBU MARU (53°N, 134°W) measured 63-kn winds, 26-ft seas, and 33-ft swells. The CAMSEL (49°N, 125°W) reported measured 80-kn east winds, no waves reported.

On the 16th the storm was stationary near 59°N, 148°W at 997 mb and weakening. The GOLDEN HAWK (54°N, 146°W) measured 44-kn west winds and 25-ft waves. On the 17th the storm was gone.

There was a report on the 15th by the EXXON LEXINGTON (14°N, 96°W) of 35-kn Tehuantepec winds, 17-ft seas, and 25-ft swells. On the 16th the EXON JAMESTOWN (13°N, 96°W) reported 56-kn north winds and 26-ft seas.

The east coast of northern Honshu supported a weak 1002 mb cyclone on the 0000 analysis of the 13th. Twenty-four hours later it was 974 mb near 38°N, 152°E. The storm curved northward, then westward and northeastward all on the 14th to make an S-shaped pattern. There were many storm-force wind reports and four of 60-kn or greater. The MARITIME LEADER (44°N, 156°E) reported 72-kn southeast winds, no waves. The SUMMIT (44°N, 158°E) measured 69-kn east winds and again no waves reported. The highest waves were 28-ft swells by the PACIFIC VICTORY at 35°N, 148°E. There were still many storm-force winds and high waves on the 15th. The SHUKO MARU (48°N, 151°E) measured 45-kn east winds and 43-ft seas. The TOKYO RAINBOW (44°N, 148°E) had 47-kn west winds, 30-ft seas, and 35-ft swells.

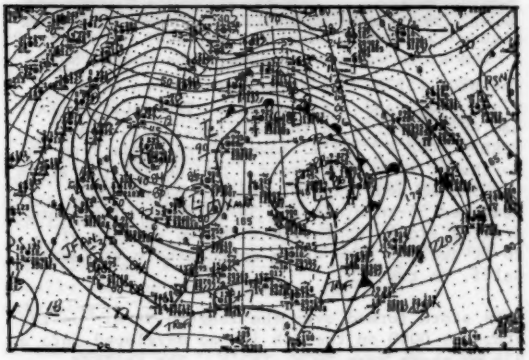


Figure 43.-- Analysis for 0000, February 16.

By the 16th the cyclone had four centers as the original only moved slightly eastward (fig. 43). The GFGS (50°N, 175°W) reported 60-kn east winds, 12-ft seas, and 20-ft swells. The MARILOCK (50°N, 158°E) had 50-kn northeast winds, 26-ft seas, and 31-ft swells. At 0000 on the 17th there were three centers to the elongated storm that stretched three-fourths of the way across the ocean. The deepest was the middle center at 976 mb near 45°N, 180°. The HOEGH DRAKE (30°N, 162°E) reported measuring 6-kn southwest winds and 15-ft seas. Other reports were of lighter winds but 25-to-30-ft waves.

The 0000 analysis of the 18th showed the original LOW had absorbed a frontal wave that had moved into the circulation and became a 964 mb storm near 40°N, 170°E. The PRESIDENT TYLER (44°N, 155°E) measured 35-kn northeast winds, 10-ft seas, and 38-ft swells. The storm was 956 mb at 0000 of the 19th. The highest wind of 50-kn was reported by the OCEAN GARNET (41°N, 175°W) and the highest waves of 30-ft by the SEA-LAND FREEDOM. The storm was weakening on the 20th with some 20-ft swells reported. The storm dissipated over southwestern Alaska on the 24th.

Another storm from the east coast of Honshu. The SUN BRIGHT with a deck cargo of logs that collapsed near 36°N, 135°E had an 18° list. At 0000 on the 22d it was 984 mb near 45°N, 147°E. There were some minimal storm-force winds and high waves. The LA CHACRA (36°N, 169°E) had 40-kn southeast winds and 38-ft seas. The UNITED DRIVE (45°N, 151°E) had only 27-kn winds, 10-ft seas but 35-ft swells. On the 23d two ships near 38°N, 145°E had winds over 50-kn and swells of 25 and 30-ft.

Another LOW had formed at the point of occlusion 1,100 mi to the east elongating the storm to the east, the MINORU (32°N, 144°E) measured 45-kn winds, 25-ft seas, and 28-ft swells. The EVER LIVING (37°N, 174°E) had 33-ft swells on the 25th that continued into the 26th. The PRESIDENT JOHNSON (50°N, 168°W) had 50-kn southwest winds, 20-ft seas, and 33-ft swells. The LOW was 970 mb at 54°N, 170°W. On the 27th the USCGC MIDGETT (55°N, 159°W) measured 38-kn winds and 33-ft seas. The storm was gone on the 28th. On the 26th the SOHO MARU No. 52 capsized in high waves south of Kamchatka. Four crewmen were picked up of who two died. Eighteen were missing.

Casualties -- The DAISHIN MARU and FUKUJU MARU collided in fog on the 7th in Kanmon Strait. The CHIBATETSU MARU ran aground in dense fog at Chiba on the 21st.

These ships reported heavy weather damage: BALATOC, CRYSTAL No. 1, SARITA, SITI FREDA, STAR INDONESA, and VIGOR.

The ALAMO 1 encountered bad weather during the period of 10th to 26th with force 8 and 9 winds. On the 19th at 2100 near 30°N, 132°E heavy waves covered the whole deck and cargo hatches. The rudder was broken and she had to be towed to port.

WEATHER LOG, MARCH 1985 -- In contrast to February, March produced an abundance of significant cyclones. There were two primary paths, one from the vicinity of Tokyo to near 52°N, 165°W where it split northward into Bristol Bay and continued northeastward into the Gulf of Alaska. This path was most active the last 2 weeks of the month. The other path was from the Kurile Islands northeastward across the Bering Sea to Cape Romanzof. This path was most active the first half of the month. Four storms crossed the U.S. West Coast between San Francisco and Seattle.

There were major differences between the monthly mean sea-levelpressure chart and its climatic counterpart (fig. 44). Normally the Aleutian Low has two centers, the primary one near 50°N, 170°E and the secondary near 55°N, 145°W. This month there was one 1002 mb Low near Kodiak Island. The Pacific High was near normally located near 35°N, 150°W at 1031 mb. this was 9 mb higher than normal.

The monthly mean sea-level pressure departure from normal or anomaly chart indicated most of the ocean had above normal pressure. The zero isoline stretched from Dixon Entrance to 50°N, 160°W to Mys Olyutorskiy. The negative area included the Gulf of Alaska and the

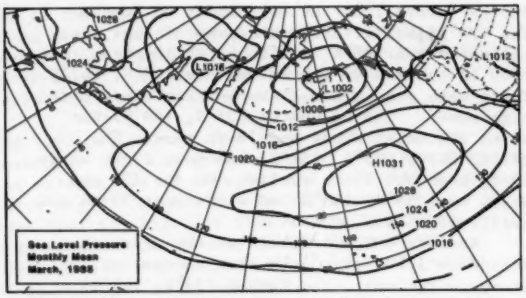


Figure 44.-- Monthly mean sea-level pressure.

northeastern Bering Sea. There was a plus 10 mb anomaly center near 39°N, 155°W and a plus 9 mb center near 47°N, 163°E. The negative center was minus 11 mb over the Laptev Sea. The minus 8 mb isoline was slightly north of the Bering Strait.

The upper air flow at 700 mb was primarily zonal between latitudes 30°N, and 60°N. There was slight ridging over the Rocky Mountains north of California and troughing over California - Nevada southward. The climatic LOW over the northern Sea of Okhotsk was missing. The primary circulation center was over the Laptev Sea.

Some Climatology -- On March 12, 1967 a 4 day storm raged over California. The storm produced 96 in of snow in 60 hr at Squaw Valley. Winds of 90 mi/hr closed mountain passes and heavy rains flooded lowlands. On the 20th in 1948 Juneau, Alaska received 31 in of snow in 24 hr, a record.

Extratropical Cyclones -- The month started with high pressure over the eastern ocean and weak LOWs the western half. By midweek the Pacific High was 1052 mb near 47°N, 155°W. High pressure covered most of the ocean except the Gulf of Alaska and east of the Kurile Islands. At the end of the first week there was a severe storm over the Bering Sea.

The second week there was a storm off the California coast and a LOW moving along the Kurile Islands. At midweek another severe storm was over the Bering Sea. By the end of the week most systems were weak.

As the third week started there was a small storm over the north-central ocean that became a large storm over the Gulf of Alaska at midweek. The Pacific High was weak. The Gulf of Alaska hosted another storm at the end of the week.

This storm continued over the Gulf as the fourth week started and another LOW departed Japan and became strong by midweek. There were two strong HIGHs now at 50°N, 165°E and 33°N, 150°W. A cut-off LOW was south of and between the two HIGHs. It broke northward by the end of the week. At the end of the month another storm had formed east of Japan.

This Gulf of Alaska storm formed north of two high pressure cells on the 2d. The storm was 996 mb at 1200 on the 3d near 56°N, 140°W. The PACIFIC PEACE (51°N, 137°W) reported 65-kn west winds, 33-ft seas, and 43-ft swells at 1800.

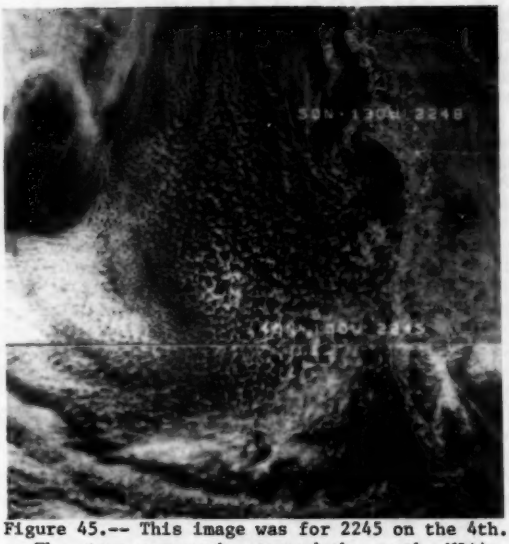


Figure 45.-- This image was for 2245 on the 4th. The storm was moving toward the south. NOAA.

The NYON (52°N, 147°W) measured 55-kn winds, 17-ft seas, and 30-ft swells. The PACIFIC PEACE had 49-ft swells on the 4th (fig. 45). The NORDPOC (48°N, 133°W) found 60-kn winds from the northwest with 33-ft seas. On the 5th the storm was 998 mb near Cape Flattery. Buoy 46002 measured 55-kn winds and 30-ft seas. The storm drifted slowly southward with two reports of 20-ft swells. The storm moved ashore at Eureka, Calif. on the 7th.

This storm formed over the Tsugaru Strait on the 5th. By 0000 on the 7th it had developed into a 978 mb storm near 50°N, 165°E. The EASTERN VENTURE at 48°N, 161°E had 67-kn winds from the northwest and 44-ft seas and swells. The SHOSHIN MARU (47°N, 166°E) measured 50-kn west winds, 13-ft seas, and 49-ft swells. On the 8th the storm was over the Bering Sea. The NYON (52°N, 170°W) measured 55-kn winds, 20-ft seas, and 33-ft swells. The STAR PHILIPPINES (49°N, 174°E) had 28-ft waves. The storm was over Cape Romanzof on the 9th.

Interior Asia produced this cyclone. It was pushed eastward by a huge 1050 mb Asian High. At 1200 on the 9th it was over the Kurile Islands. The ELDA (47°N, 154°E) had 50-kn winds, 23-ft seas, and 30-ft swells. On the 11th the NYON was still trying to make headway westward. She now had 65-kn west winds, 20-ft seas, and 46-ft swells. The ORIENTAL HIGHWAY (48°°N, 173°E) had 40-kn winds, 8-ft seas, and 33-ft swells. The storm was 960 mb near 55°N, 175°E. The storm was northwest of Saint Paul Island at 0000 on the 12th at 968 mb. The GOLDEN COAST (53°N, 170°W) measured 57-kn winds and 28-ft seas and swells. The storm was weakening further on the 13th with buoys 46001 and 46003 both reporting 20-ft waves.

A front with a series of frontal waves lay south of Japan on the 13th. On the 14th one of these

waves continued to develop and raced eastward. On the 16th it was 976 mb near 47°N, 177°W. The EASTERN GLORY (44°N, 172°W) had 49-kn south winds, 26-ft seas, and 30-ft swells. The OCEAN STEELHEAD (39°N, 174°E) had 53-kn, 12-ft seas, and 25-ft swells. The RICHMOND BRIDGE (49°N, 161°W) had 45-kn winds and 23-ft swells on the 17th. At 0000 on the 18th the storm was 964 mb near 56°N, 162°W and making a cyclonic loop. The DIAHO MARU (54°N, 157°W) had 52-kn winds, 13-ft seas, and 23-ft swells. Many other ships were reporting 40-to 50-kn winds and 20-to 23-ft waves. After the loop the storm continued northward weakening rapidly.

The Kurile Island of Ostrov Urup was the birth place of this storm on the 18th. The LOW moved eastward and under zonal upper-air flow sped to 47°N, 179°E by 0000 on the 20th. The PRESIDENT GRANT (47°N, 172°W) had 40-kn southeast winds. The DUEE (43°N, 177°E) had 54-kn west winds, 13-ft seas, and 21-ft swells. On the 21st the storm was 980 mb near 52°N, 157°W. The KOWA MARU (48°N, 156°W) measured 50-kn southwest winds, 15-ft seas, and 26-ft swells. The EASTERN GLORY and RATNA DEEP both near 48°N, 132°W had winds of 48 and 45-kn and 31-ft swells with the GLORY reporting 34-ft seas, respectively.

At 0000 on the 22d the storm was 976 mb near 56°N, 148°W. There were several reports over 50-kn and waves of 30-ft. Three ships reported winds of 60-kn or more. They were the RATNA DEEP, UNITED FAITH, and ALUCOM. The PRESIDENT TYLER (54°N, 151°W) measured 55-kn winds, 12-ft seas, and 33-ft swells. The winds were 52-kn and swells 30-ft on the 23d. As usually happens the storm was rapidly weakening.

On the 24th there were two large 1034 mb HIGHs, one near 40°N, 145°E and the other near 35°N, 150°W. There was a large LOW north of and between the two. Waves were formimg on the front out of the LOW, south of the western HIGH. On the 25th one of the frontal waves continued to develop and on the 26th started to squeeze northward between the HIGHs. The PRESIDENT WASHINGTON (39°N, 178°E) had 55-kn northeast winds, 18-ft seas, and 23-ft swells. At 0000 on the 27th the 980 mb storm was near 42°N, 179°W. The UNKAI MARU (45°N, 179°W) measured 62-kn northeast winds, and 26-ft seas. At 1200 the storm was 960 mb (fig. 46). The VENTURE STAR

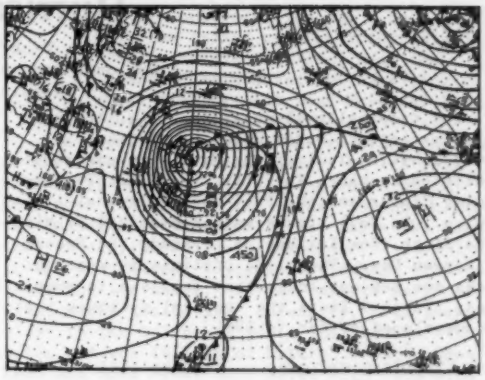


Figure 46.-- A larger view of the meteorological picture at 1200 on the 27th.

(40°N, 178°E) reported only 40-kn winds but had 33-ft seas which continued into the 28th. Several ships had 20-ft swells. Another ship which may have been the BOGASARI LIMA on the west side of the storm had 34-ft swells. The strom was weakening and dissipated on the 31st.

Casualties -- These vessels had problems with fog. The HUACHO 5 grounded on the 5th. The HWA LIE contacted the breakwater entering Keelung harbor and collided with the LILIANA on the 8th. The EASTERN CORRIDOR and STRAIT CONTAINER collided east of Hong Kong on the 16th.

The CRESTBANK dragged anchor in strong winds and contacted the A. CHENG on the 9th. The HOJIN MARU also dragged anchor at Yokohama in strong winds on the 25th and contacted the MONTE EMERALD. The HAEYUNG SILVR grounded at Busan Outer Harbor on the 20th and broke in two.

The ABBEY lost an anchor and 13 lengths of cable in heavy weather. The SE JIN No. 102 sank in high seas off Cheju Island on the 15th. The GOLD PETREL was missing in heavy swell south of Saigon. The RYOFUKU MARU was washed by side waves and developed a list on the 19th near Fukuoka. The crew abandoned ship which was grounded.

The AFRICANA radioed of steering failure amid Antarctic icebergs and bad weather in the Southern Ocean. The winds were reported as force 12.

Hurricane Alley

Dick DeAngelis
National Oceanographic Data Center
Washington, D.C.

The tropical cyclone tracks (fig. 47) and the summaries are based upon information provided by Ted Tsui of the Naval Environmental Prediction Research Facility, the Joint Typhoon Warning Center and the Fiji Meteorological Service. In Fuji storms were summarized by Miss Sudha Singh, Ram Krishna, S.C. Ready, R. Prasad and Sarwan Dey. These are preliminary reports. Tracks are subject to further analysis in some cases. Table 9 lists the tropical cyclones that have developed so far in 1985.

TROPICAL CYCLONES -- JANUARY 1985

Eleven tropical cyclones developed this month, including two tropical storms in the North Pacific, with six hurricans and three tropical storms roaming the Southern Hemisphere. This was well-above average mainly due to the South Pacific activity.

The two tropical storms in the North Pacific, Elsie and Fabian, formed early in the month and were confined to south of 15°N. Both were short lived. To the south, however, hurricans Eric and Nigel ravaged the Fiji Islands. Both took very similar tracks and crossed the Islands within 2 days of each other. Nigel formed farther west. Another hurricane, Odette formed in the Coral Sea about the time Eric and Nigel were beginning to move on Fiji. Eric was the first of the small hurricanes to strike, while Nigel followed during the afternoon of the 19th, some 48 hr later. This has never happened before in the recorded history of the Southwest Pacific.

On the 13th a shallow depression appeared, along an active section of the monsoonal torugh, with its centre about 450 mi to the west of the Island of Espiritu Santo, Vanuatu. Successive GMS (Geostationary Meteorological Satellie) photos on the 13th and 14th showed an increase in the cyclonic curvature of the convective cloud and a slow eastward movement of the entire cloud system associated with the depression. By 0600 on the 14th the Joint Tropical Cyclone Warning Center reported that prospects for significant tropical cyclone development were good. At 1200 the depression was centered about 150 mi to the west of Espiritu Santo. Around this time, it seemed to be undergoing rapid development as the cyclonic shape of the depression became better defined. By 1600 it was estimated to have gale-force winds close to the center and further development seemed almost centain. On that expectation, the depression was upgraded to a tropical storm and named "Eric".

Eric developed further as it continued to move eastwards at about 8 kn. Just before 1200 on the 15th, it passed close to the Island of Espiritu Santo at near storm intensity. As Eric moved away from Vanuatu, it altered its course slightly towards the east-southeast and increaged its forward spped to 11 kn. Over the next 24 hr the cyclone seemed to exhibit a slower rate of growth than earlier in its life history as a result of weaker convective cloud bands curling into the central area of the system. The cloud associated with the cylone also appeared to undergo some kind of reorganization, making it difficult to locate the center with any degree of accuracy until the eye was revealed in the GMS imagery at 1600 on the 16th. This vivible evidence of an eye confirmed its intensity as hurricane force. An Air Pacific flight bound for Honiara from Nadi was able to view the eye on the radar scope.

Tropical cyclone Eric picked up speed to 15 kn as it came within range of the Nadi surveillance radar at 0030 on the 17th. The eye was clearly defined on the radar screen as a ring of echoes at a distance of 140 mi on a bearing of 270 degrees with a diameter of about 25 mi. The team at the Nadi Tropical Cyclone Warning Center was able to locate the position of Eric on the radarscope every hour until about 0700 when the cyclone was centered about 50 mi to the west-northwest of Nadi and winds were gusting up to 70 kn at Nadi Airport. Further operation of the radar would have exposed the antenna to the possibility of damage from the high winds. The radar antenna was therefore locked in the least resistance attitude during the period of most damaging winds at Nadi Airport. At 0800 the center was lying close to Malolo Island in the Mamanuca Group.

As Eric drew closer and closer to western Viti Levu, it gathered momentum with the forward speed increasing to 26 kn. The diameter of the eye seemed to contract to about 10 mi as the cyclone made landfall on Viti Levu about 5 mi south of Nadi. An eyewitness on Tavarua Island, located about 5 mi to the south of Malolo Island, gave an account of how the southern part of the eye passed overhead between 0815 and 0845 on the 17th before the winds picked up again to hurricane force from a southwesterly direction. Nadi was very close to the northern part of the eye but the winds did not actually drop off as is characteristic with the passage of an eye.

The surveillance radar at Nadi was brought back into operation again at about 1045 following a substantial decrease in the wind. Its image showed how the landmass of Viti Levu had modified the eye region of Eric but the topography didn't seem to have any effect on the forward speed of the cyclone. Eric continued to move east-southeast at about 26 kn and appeared to lose intensity near south-eastern Viti Levu.

Over the Koro Sea, Eric, with storm intensity, held the same course and spped of movement as its center passed about 10 mi to the south of Moala at about 1430 on the 17th. A short time later, Eric exited the Fiji Group on a course for the Haapai Island Group in Tonga. At about 0300 on the 18th the center of Eric seemed to slip just to the south of Monuka Island in the Haapai Group. A report from the Meteorological Office in Nukualofo suggests that the cyclone was still of storm intensity as it moved through Tonga.

Just after 1200 on the 16th, the maximum sustained winds (10 min average) near the center were estimated to have reached 65 kn. Eric gradually acquired an estimated peak intensity of 100 kn at about 0000 on the 17th. By the time Eric had crossed Viti Levu he had lost his hurricane force winds. During the afternoon of the 18th, he passed through Tonga with estimated storm intensity. At Nadi Airport, the wind steadily increased during the afternoon of the 17th to reach storm force (winds over 47 kn) by 0700. Between 0800 and 0900, hurricane force winds up to 72 kn were experienced with a maximum gust of about 105 kn at 0805.

At Laucala Bay (Suva), the wind gradually increased during Thursday evening (17th) to reach gale force (over 33 kn) about 1015 but very quickly rose to storm force by 1100. Close to 1130, the 10-min average wind reached a peak of just under hurricane force with a maximum gust of 91 kn. At Nausori Airport, the wind gradually increased to gale force by 0930 and storm force by 1045 on the 17th. The wind reached a 10-min average peak of 50 kn at 1110 with a maximum gust of 77 kn.

The storm and hurricane force winds associated with Eric produced very severe damage to Lautoka, Nadi, the Islands of the Mamanuca Group and the interior parts of central western Viti Levu. Other, less severe damage occurred at Suva, Lami, Navua, Deuba and the interior parts of southeastern Viti Levu.

The unofficial death toll for Eric is 25. Several hundred other people were left with serious or minor injuries in the wake of the cyclone. A preliminary estimate of the damage caused by Eric totals at least $40 million.

The devastating effects of Eric can readily be seen in the following list of damage left in its wake:

1) Partial or complete destruction of homes and villages (leaving many thousands without shelter), schools, tourist resorts, the Nadi Airport hangar, crash, fire and terminal buildings, various commercial edifices and recreational facilities.
2) The disruption of electricity and communications as a result of fallen and broken telephone and power poles, wires and cables (the lowering of Radio Fiji's main transmitting and support towers in Lautoka caused very poor reception for listeners in the Western Division).
3) The uprooting, breaking and flattening of trees, crops and plants (a few of the large raintrees lining the Queens Road near Lautoka which have withstood the tet of other tropical cyclones in the past 100 yr or so were uprooted during the passage of Eric).
4) The interruption of water supplies in some places.
5) Flooding chiefly in low-lying areas close to river systems with associated stock and crop losses.
6) The sinking of the Government vessel. NA MATAISAU near Moala Island resulting in the loss of 2 lives, the groundings of the Government Tug No. 7 on a reef near Gau Island and the inter-island vessel, ZEPHYR on a reef near the Island of Matuku and the capsizing of a small fishing boat near Naselsai Reef (Suva) with the loss of one life.

No significant damage was reported on land as the result of a storm surge. At its peak intensity, Eric was approaching western Viti Levu near the time of low water. Although there was an increase in water levels above the normal tide levels, probably in the order of 2 to 3 m, it was insufficnet to cause any damage to areas above the sea shore. In the eastern parts of Fiji, after losing some intensity, Eric passed close to the Island of Moala just before high water and the Islands of Kabara, Fulaga, Ogea Levu and Ogea Driki just after high tide with no apparent damage to crops and structures from a storm surge.

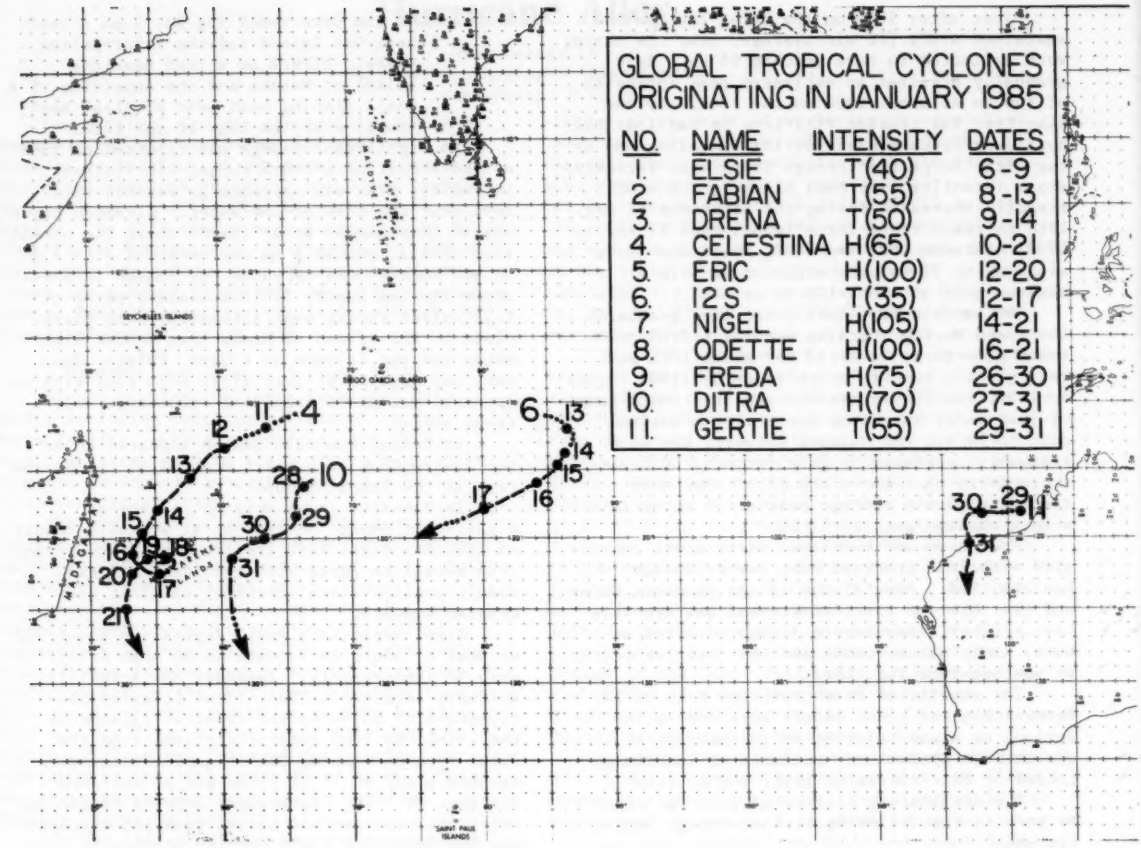
In Tonga, the main damage appeared to be the destruction of a wharf and 80% of the banana crop in the Haapai Group.

In Vanuatu, there were no reports of significant damage on land or at sea as a result of Eric but Nigel left its trail of destruction. This seemed to agree with the idea that Eric didn't acquire storm intensity until it had crossed Vanuatu.

Nigel began as a small depression about 900 mi west of Santo in Vanuatu in an area devoid of ship or land reports. Japanese GMS satellite pcitures received at Nadi first revealed the signature of an incipient tropical cyclone on the 15th. By 1800 reports received from the Joint Typhoon Warning Center gave estimated maximum winds of 15 to 25 kn and an eastward movement of 7 kn. Subsequent reports (based on satellite observations during Guam and Brisbane and the Satellite Field Service Station in Honolulu gave estimated maximum sustained winds of below 40 kn. By 1700 on the 16th the eye had become distinct in satellite pictures and Nigel was estimated to have become a hurricane with sustained winds of about 65 kn, moving due east at a speed of about 15 kn and accelerating.

By 0930 on the 17th Eric had caused loss of telephone and telex communications with Suva and hence the outside world. No reports on the cyclone could be received from outside Fiji. Satellite pictures received at Nadi indicated that Nigel was centered about 50 mi to the east of Santo in Vanuatu at 0000 on the 18th, moving eastward at about 18 kn.

Janapnese GMS satellite pictures indicated that the system, while continuing to accelerate eastward, had begun to take a slight southward turn. By 2230 on the 18th, Nigel was moving east-southeast at about 20 kn and the eastern segment of its eye-wall began to appear indistinctly on the Nadi Airport Surveillance Radar at a distance of about 195 mi west-northwest of Nadi. By 0300 on the 19th the cyclone had estimated maximum sustained winds of about 75 kn with gusts to 110 kn as assessed from satellite pictures. As the system moved closer to Nadi and the eye became more distinct on the radar screeen, it was becoming evident from the large clear area adjacent to the eye wall that the system was beginning to



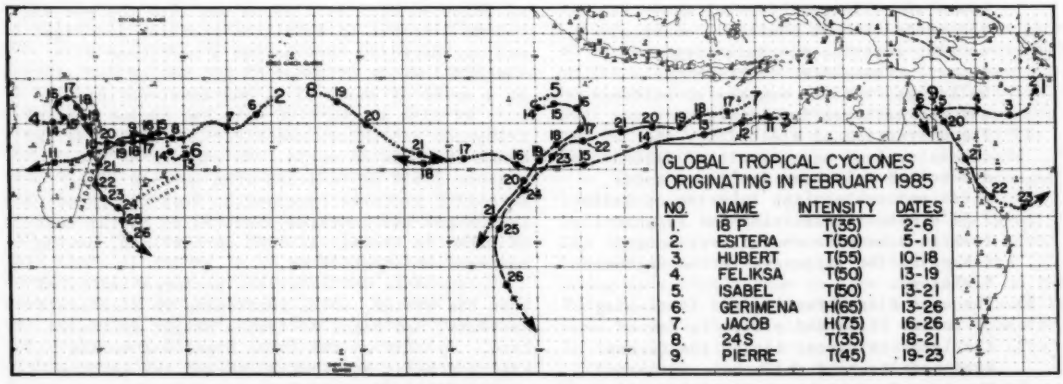
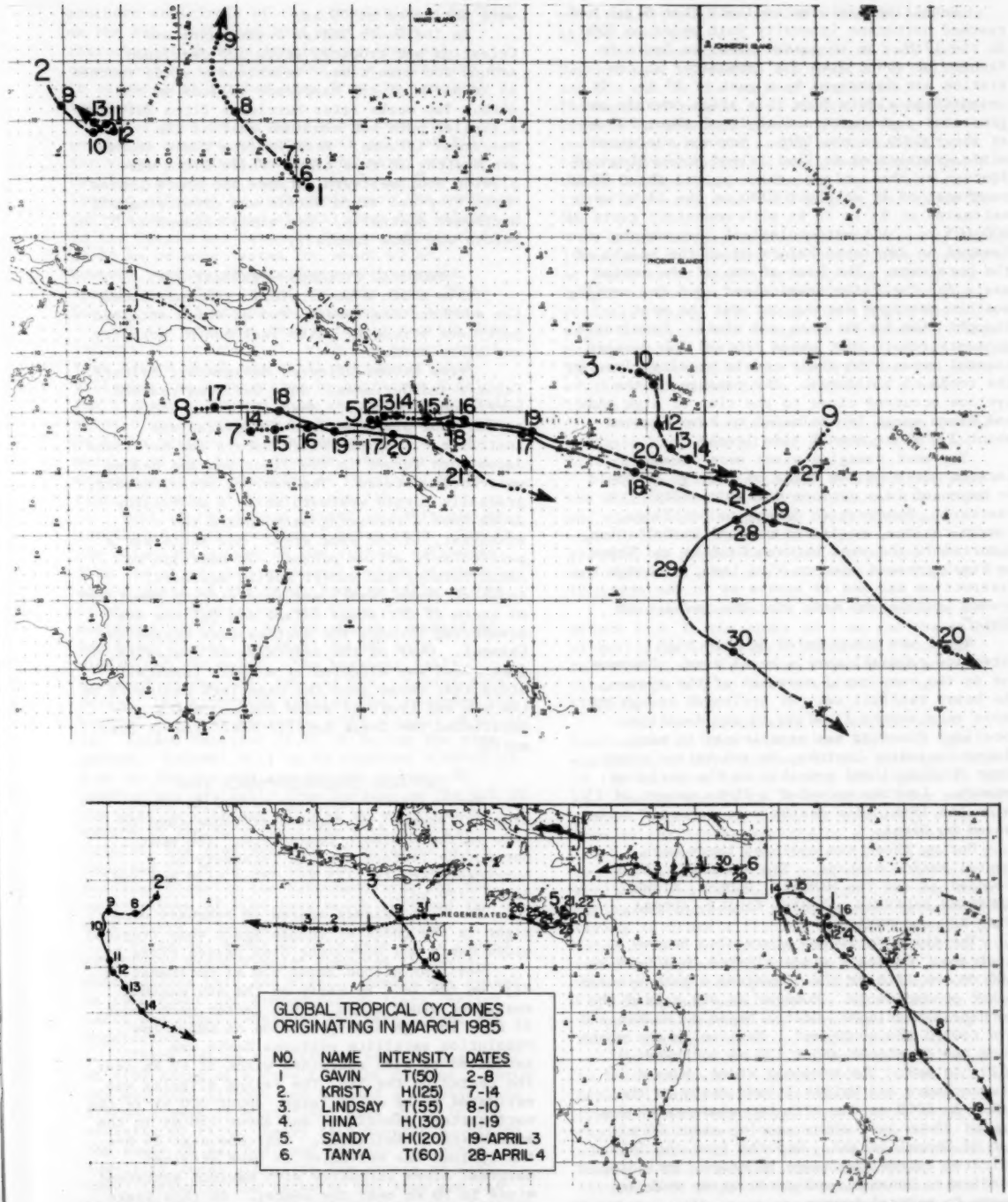


Figure 47.-- Tropical cyclone charts for January, February, and March, 1985.

weaken slowly, possibly due to strong verticle shearing influences aloft and incursion of cool dry air driven up from high latitudes by the circulation of cyclone Eric towards Nigel's center. By 0400 Nigel's eye was passing close to the southern islands of Yasawa Group and northern Mamanucas, moving east-southeast at a speed close to 30 kn. The center of the eye crossed the coast of Viti Levu close to the west of Ba at about 0515. As the system moved inland its circulation weakened further due to friction and decreased mositure intake, and the intensity quickly dropped to gale force with maximum sustained winds estimated at about 45 kn.

The system crossed eastern Viti Levu maintaining gale intensity, and began a slow turn eastward. By about 0900 the center of Nigel lay close to the island of Wakaya in the



Lomaiviti Group, moving eastward at about 20 to 25 kn. On its track across Viti Levu, Nigel brought hurricane force winds and very heavy rain to the southern islands of the Yasawa Group including Waya and Viwa islands, the northern islands of the Mamanuca Group, and a small segment of Viti Levu between Lautoka and Tavua and the interior of Viti Levu. A small portion of the remaining northwestern section of Viti Levu and some parts of the Yasawa and Mamanuca Groups sustained storm-force winds. Gales affected many other parts of the group.

Satellite pictures indicate that Nigel had reached hurricane intensity just prior to 0000 on the 17th. As it passed close to Santo in Vanuatu at about 2140 the anemometer at the station was destroyed by a gust of 85 kn. It intensified slowly from this stage onwards and generated peak sustained winds of about 105 kn at about 0300 on the 19th. Maximum sustained winds experienced at Viwa Island Meteorological Station as the cyclone center passed about 20 mi southwest of it at about 0330 on the 19th, were estimated at 65 to 70 kn with momentary gusts of 100-105 kn. All meteorological instruments were damaged or destroyed before or at the height of the hurricane. The base of one of the aerial masts for the radio transceiver used for sending weather messages was dug out and the mast brought down by the seas and winds. Eyewitness accounts relate that waves crossed the western coastal areas with their crests passing close to the roofs of buildings. The passage of the cyclone occurred close to the time of high tide and storm surge is estimated to have reached about 3 m above normal tide levels.

The most damaging winds were clearly located north of the track of the eye as would be expected in a cyclone moving rapidly eastward. Substantial damage to buildings, communications, roads and coastal installation, occurred in the area between Lautoka and Tavua as Nigel crossed western Viti Levu, although the destruction was not as severe as in the area around Lautoka and Nadi with the passage of "Eric".

Nigel was accompanied by very high intensity rainfall over a small area. However, due to the very rapid movement of the system, the heavy rainfall was not prolonged enough to cause very severe flooding in any locality. Localized flooding was experienced in many places including Lautoka, Ba and Wailoa river (near Monasavu) and possibly in the outlying islands. Lautoka recorded a 24-hr amount of 15 in on the 19th. Six deaths were reported to be caused by Nigel.

During these two cyclones there were several marine mishaps. The HAO CHUEN NO. 1 grounded as did the MANGARU, DEDELE, KISMET, FEDERESEN NALKUTAN, ATCHIN, KALILI, AURORA, LUNA, KEO and ONMA.

The third Coral Sea storm also became a hurricane. Odette's winds climbed to 100-kn at 0600 on the 19th as she traversed a path similar to her predecessors. However as she neared the New Hebrides Islands, Odette began to weaken and turn toward the southeast. Earlier in the month Drena had developed about 120 mi northwest of Wallis Island. The tropical storm, passed between Samoa and Wallis Island early on the 11th. By 0000 on the 12th her winds reached a peak of 50-kn just after passing about 20 mi west of Keppel Island. Reports from the Island indicated extensive damage to crops, including breadfruit, bananas, and coconuts as well as damage to several houses.

Late in the month Freda reached hurricane strength in the South Pacific. She formed about 80 mi west-northwest of Aitataki in the Southern Cooks on the 26th, which was as close as she came to any inhabited island. Her maximum winds were estimated at 75 kn.

In the South Indian Ocean hurricane Celestina and tropical storm 12S developed around the same time. Celestina's winds reached 65 kn north of the Mascarene Islands on the 14th. Two weeks later hurricane Ditra followed a similar path but remained east of the Mascarene Islands. Details from these storms are sketchy at this time. While Ditra was plowing southwestward, across the South Indian Ocean tropical storm Gertie was developing off Northwest Australia. Her winds climbed to 55 kn before she made landfall.

TROPICAL CYCLONES--FEBRUARY 1985

This month nine tropical cyclones roamed the southern hemisphere, two of which attained hurricane strength. Like last month, activity was above normal.

Three storms affected Madagascar; Esitera, Feliksa and Gerimena. Only Gerimena reached hurricane intensity. Most of this month's action took place between Madagascar and Australia. Tropical storm Hubert and hurricane Jacob both formed in the Timor Sea and headed west-southwestward. The earlier storm, Hubert, gradually turned westward while a week later Jacob took a recurving path toward the southwest, in the same area. Mid-month was a particularly active period. In addition to Jacob forming and Hubert moving westward, tropical storm Isabel was intensifying about 180 mi south of Christmas Island and Feliksa was meandering through the northeastern Mozambique Channel. Over on the east side of Australia, Queensland was affected by a small tropical storm that moved onto the Cape York Peninsula on the 6th and tropical storm Pierre, which paralleled the Great Barrier Reef late in the month.

TROPICAL CYCLONES--MARCH 1985

March activty was near normal as three tropical storms and three hurricanes came to life in the Southern Hemisphere. The most noteworthy feature was the intensity of hurricanes Kristy (125 kn), Hina (130 kn) and Sandy (120 kn).

The Fiji Islands spared in February were right in the thick of things again when tropical storm Gavin and hurricane Hina passed close by.

Gavin developed about 450 mi northwest of Fiji on the 2d. By early on the 4th maximum sustained winds close to his center were about 35 kn. Through interpretation of GMS-3 low resolution satellite pictures Gavin was estimated to have sustained winds of 40 kn near the center on the 5th. The radius of gales was estimated to be quite large, about 300 mi in the northeastern semicircle and about 150 mi in the southwestern semicircle. Over the next 24 hrs. the cyclone was estimated to have attained marginal storm intensity with maximum sustained winds fo 50 kn near the center. At this stage it was centered about 240 mi southwest of Nadi. There was no significant change in the intensity of Gavin on the 6th and the 7th as it continued to move along a southeasterly track at an average speed of 10 kn. However the wider area of gales was assessed to have spread into the

southern semicircle of the circulation. By 0600 on the 8th, Gavin had lost most of the characteristics of a tropical cyclone and consequently, was downgraded to a depression as it accelerated further away from the tropical latitudes.

Near gale or stronger winds from the northerly quarter affected most parts of Fiji for varying periods between the early morning of the 5th and the morning of the 7th. The areas longest affected by such winds were the northern and the western parts of Viti Levu and islands in the Yasawa and Mamanuca Groups, where winds of 25 kn or more lasted for about 40 hr. However, winds, of gale force with average speeds over 33 kn lasted for only about 20 hr but not in all of the above-mentioned areas.

Of the stations that normally provide wind information around Fiji, with the exception of Viwa Island which was still non-operational following the destruction by hurricane Nigel, the highest sustained wind was recorded by Nadi Airport which reported 42 kn and maximum gusts of 64 kn between the evening of the 5th and morning of the 6th. However, the overall maximum gust was recorded at Ono-i-Lau which reported gusts of 65 kn on the 7th.

Most of the damage caused by Gavin can be attributed to the prolonged heavy rain. Due to the extensive nature of the system, rainbands from the associated monsoonal trough started to affect parts of the Group from as early as the 2d when the depression was lying far to northwest of Fiji. As the system intensified and moved closer, rainfall became more widespread and heavy. The heaviest falls occurred on the 4th, 5th and 6th. During this period, the reporting station that recorded the highest fall was Monasavu, with a total of 27.44 in. Kora-O received 21.81 in during the same period. Rarawai Mill in Ba recorded a total of 9.44 in for the 4th and 5th inclusive. No reading was available from Rarawai on the 6th as the station site was flooded by overflowing waters of the Ba river. The highest 1-day rainfall was also recorded at Monasavu which reported 13.86 in for the 5th. Monasavu is situated clsoe to the catchment area for the major rivers of Viti Levu which suffered the most severe flooding during the cyclone.

Sustained winds of only gale force caused relatively minor damaged compared to Gavin's predecessors Eric and Nigel. Damage was caused to some power and communication lines, relief tents and other temporary shelters, crops and vegetation.

There was no significant rise in sea level or stom surge as a result of the cyclone. Gavin was not very intense and tracked a considerable distance away from any land mass while in the vicinity of Fiji. Heavy rain brought bloods to the towns of Ba, Nadi and Lautoka and other low-lying areas alongside the rivers of Viti Levu, including the banks of the Rewa and the Sigatoka rivers. Roads and bridges were flooded and closed to all traffic for considerable periods of time, especially over the main island. Crops and vegetation were either severely damaged or swept away in many flooded areas. Losses of lifestock is likely to have occurred although no specific mention was made in the news media.

The international airports at Nadi and Nausori were closed to all traffic on the 5th and 6th due to the weather conditions. Thousands of people took shelter in evacuation centers in affected areas. Floods in combination with the strong winds caused temporary disruption to the power supply and communication links including the break-down of the AFTN circuits at Nadi Airport for about 24 hr.

Local newspapers reported the loss of three lives, two by drowning and one by electrocution. At least seven people were missing during the height of the cyclone. Possibly, due to the prolonged heavy rain about the time of Gavin, a major landslide was triggered at Namara village on Waya island in the Yasawa Group, about a week later. No injuries were reported but the site of the village had to be shifted to a new location.

Unofficial estimates of the damage caused by Gavin have been placed at about a million Fiji dollars.

Shipping damage caused by Gavin included the WELLINGTON STAR which sustained structural and electrical damage. A local passenger vessel, MATTHEW FLINDERS, dragged anchor and grounded at Saweni Bay, Lautoka on the 5th. She was refloated with the assistance of tugs on the 10th.

Hina was the fourth tropical cyclone to affect Fiji in the space of 2 mo and the third of hurricane intensity. Historical records reveal that the last time three hurricanes occurred in a 2 mo period was 110 yr ago (1875).

Hina was potentially one of the worst hurricanes to have approached Fiji. It was estimated to have maximum 10 min average winds of 120 kn close to its center with gusts to 160 kn. During the 24 to 36 hr before Hina made its closest approach to Fiji, it gradually recurved from an east-southeasterly to a southeasterly track so that the most destructive winds of the cyclone passed over the open sea to the west of Viti Levu and Kadavu. Only one life was lost during the cyclone - a Nadi farmer drowned while trying to cross a flooded creek. The very low fatality and injury figures recorded during Hina could be explained partly by the fact that the worst part of the wind circulation kept off the Fiji Group and partly by the fact that the level of public awareness was very high following the recent passages of Eric, Nigel and Gavin.

At 0000 on March 12 a depression that was to become Hina was located about 140 mi east of Espiritu Santo Island in Vanuatu. A drift towards lower latitudes, contributed towards its rapid development. Around 1200 the 13th, Hina was estimated to have acquired storm intensity. During a 12 hr period after this time, an established ridge of high pressure over the Coral Sea influenced the movement of the cyclone and apparently helped steer it away to the north. At about 0000 on the 14th, Hina turned towards the right, to follow a northeasterly course and it continued to intensify up to hurricane strength by 1200. Between 1200 on the

14th and 0000 on the 15th, Hina moved towards the east at 8 kn, double the past speed. During the period in which the cyclone had described a pronounced parabolic path between latitudes 15°S and 11°S, Hina intensified quickly to a full-fledged hurricane. A very small, indistinct eye appeared to show up in the Janapnese GMS-3 (Geostationary Meteorological Satellite) picture just to the west of Vanikoro in the eastern part of the Solomon Islands group on the 14th. However, an eye did not appear as a regular feature in the satellite imagery until after 0000 the 15th. At this stage it became clearly visible in both the GMS-3 amd Meteor 2-11 (Russian polar orbiting satellite) pictures.

Between 0000 and 1200 on the 15th, Hina turned towards the east-southeast and picked up speed to 12 kn. It continued to intensify and the maximum sustained winds were estimated to have reached 100 kn with gusts to 140 kn around 1200 on the 15th. Reports in the vicinity of the system indicated that Hina had a small diameter circulation, very tightly wound up near the center. Its track seemed to take it close to Tikopia Island in the eastern Solomons.

Hina progressed further towards the east-southeast and continued to intensify. It gradually recurved to the southeast at about 17 kn on the 16th. During this same period, the shape of its entire cloud system seemed to undergo a marked stretching southwards along the longitudinal axis. At around 1200 Hina was deemed to have reached its maximum intensity with maximum sustained winds of 130 kn and gusts up to about 160 kn near the center. That occurred about the time when Hina first came into radar view at Nadi Airport. Hina produced some spectacular echo signatures on the radarscope throughout the night until it was located about 80 mi from Nadi along a bearing of 267 degrees at 1830 on the 16th. By this time the winds at Nadi Airport were gusting up to 80 kn so the radar antenna had to be locked in an attitude of least resistence for protection.

A comparison between the maximum windspeed reports at Nadi Airport and Vunisea (Kadaru) suggests that Hina had weakened to some extent during its brief passage near the western most part of the Fiji Group.

The extension of an upper-level trough into tropical latitudes helped to steer the cyclone along a track that would take the central and most devestating part of Hina just out of reach of any of the Islands in the Fiji Group. While Hina was passing about 60 mi to the southwest of Nadi Airport on the 17th, the winds there rose to a maximum 10 min average of 64 kn with a maximum gust recorded at 95 kn. The southwestern tip of Viti Levu including Sigatoka would have also experienced similar or slightly stronger winds as the center of Hina drew close to 40 mi southwest of Viti Levu at its nearest approach.

Storm or hurricane force winds among the islands in the Yasawa and Mamanuca Groups, over southwest Viti Levu west of a line from Ba to Korolevu, Vatulele, and Kadavu caused damage to some buildings and miscellaneous amentities but in no way could these be compared with the severe losses incurred during the passages of Eric and Nigel in January. If the very destructive winds closer to the center of Hina had moved nearer Fiji, the damage could have been much worse and more widespread.

Widespread flooding did occur about northern and western parts of Viti Levu, the Mamanucas, Kadavu and Vatulele. Most of these places were affected by flooding 11 days beforehand in asociation with tropical cyclone Gavin. Although the flooding seemed to be worse during Hina, the rainfall amounts in the catchment areas of the main river systems seem to have been much less. However, the initial groundwater levels in these areas would have been much higher as a result of the rain received during tropical cyclone Gavin. The Ba bridge was flooded for the second time in less than 2 wk and the floodwater levels in Nadi town rose again, this time to 1-2 m. A large percentage (60% in parts of the Sigatoka Valley) of recently planted crops and crops that had survived the other recent cyclones sustained damage or were destroyed. Several river crossings about the interior of Nadi and Sigatoka including the Draiba bridge were washed away. Landslides were triggered in many places and, as a result of one, the pipeline between the Vaturu Dam and the Nagado Treatment Plant was broken at several points. This mishap caused interruptions to the supply of water to both Nadi and Lautoka for a few days.

A storm surge of 1 mi or so was estimated to have occurred along the southwest Viti Levu coast especially between Vuda and Momi Bay at the time the cyclone was situated closest to Viti Levu. The normal tidal levels were more than half way to low water when the greatest effect of a storm surge would have been felt over southwest Viti Levu. There have been no reports of any damage as a result of this surge.

Reports from the Solomon Islands have classified Vanikoro, Utupua and Tikopia as disaster areas. Apparently, a significant storm surge was experienced over Tikopia during the passage of Hina, around 0900 on the 15th, causing the destruction of the hospital and many other buildings. The island of Santa Cruz suffered less severe damage than Vanikoro, Utupua and Tikopia; however some buildings lost their roofs.

Kristy roamed the waters of the central South Indian Ocean for a week. She was of hurricane intensity from the 8th through the 12th. On the 10th maximum winds were estimated at 125 kn with 100 kn winds extending out 45 mi and gales reaching out to about 300 mi. The other major hurricane, Sandy, formed and intensified in the Gulf of Carpentaria in a very short period of time. Before barging ashore west of Limmen Bight on the 24th, maximum sustained winds had climbed to 120 kn. The stom played havoc with trawlers in the Gulf, beaching the KFV HAYMAN and the SEA FEVER within 200 mi of each other. Sandy also caused severe damage at Bing Bong Station. In early April Tanya, which had formed in late March, moved through the Gulf but as a depression. Tropical storm Lindsay developed in the Timor Sea and moved ashore along Eighty Mile Beach in Western Australia on the 9th.

Table 9.— Tropical Cyclone Watch, 1985

Australia - South Pacific

Drena	9P	T	Jan.
Eric	11P	H	Jan.
Nigel	13P	H	Jan.
Odette	14P	H	Jan.
Freda	16P	H	Jan.
--	18P	T	Feb.
Hubert	20S	H	Feb.
Jacob	25S	H	Feb.
Pierre	26S	T	Feb.
Gavin	27P	T	March
Lindsay	29S	T	March
Hina	30P	H	March
Sandy	31P	H	March
Tanya	32P	H	March
Gretel	34P	T	April
Margot	35S	H	April

South Indian Ocean

Celestina	10S	T	Jan.
--	12S	T	Jan.
Ditra	15S	H	Jan.
Gertie	17S	T	Jan.
Esitera	19S	T	Feb.
Feliksa	21S	T	Feb.
Isabel	22S	T	Feb.
Gerimena	23S	H	Feb.
--	24S	T	Feb.
Kristy	28S	T	March
Helisaonina	33S	H	April

Western North Pacific

Elsie	TD 1W	T	Jan.
Fabian	TD 2W	T	Jan.
Gay	TD 3W	H	May
Hal	TD 5W	H	June
Irma	TD 6W	H	June
Jeff	TD 7W	H	July
Kit	TD 8W	T	Aug.
Lee	TD 9W	T	Aug.
Mamie	TD 10W	H	Aug.
Nelson	TD 11W	H	Aug.

Eastern North Pacific

Andres	TD 1E	T	June
Blanca	TD 2E	H	June
Carlos	TD 3E	T	June
Dolores	TD 4E	H	June
Enrique	TD 5E	T	June
Fefa	TD 6E	T	July
Guillermo	TD 7E	T	July
Hilda	TD 9E	T	July
Ignacio	TD 11E	H	July
Jimean	TD 10E	H	July
Kevin	TD 12E	T	July
Linda	TD 13E	T	July
Marty	TD 14E	H	Aug.

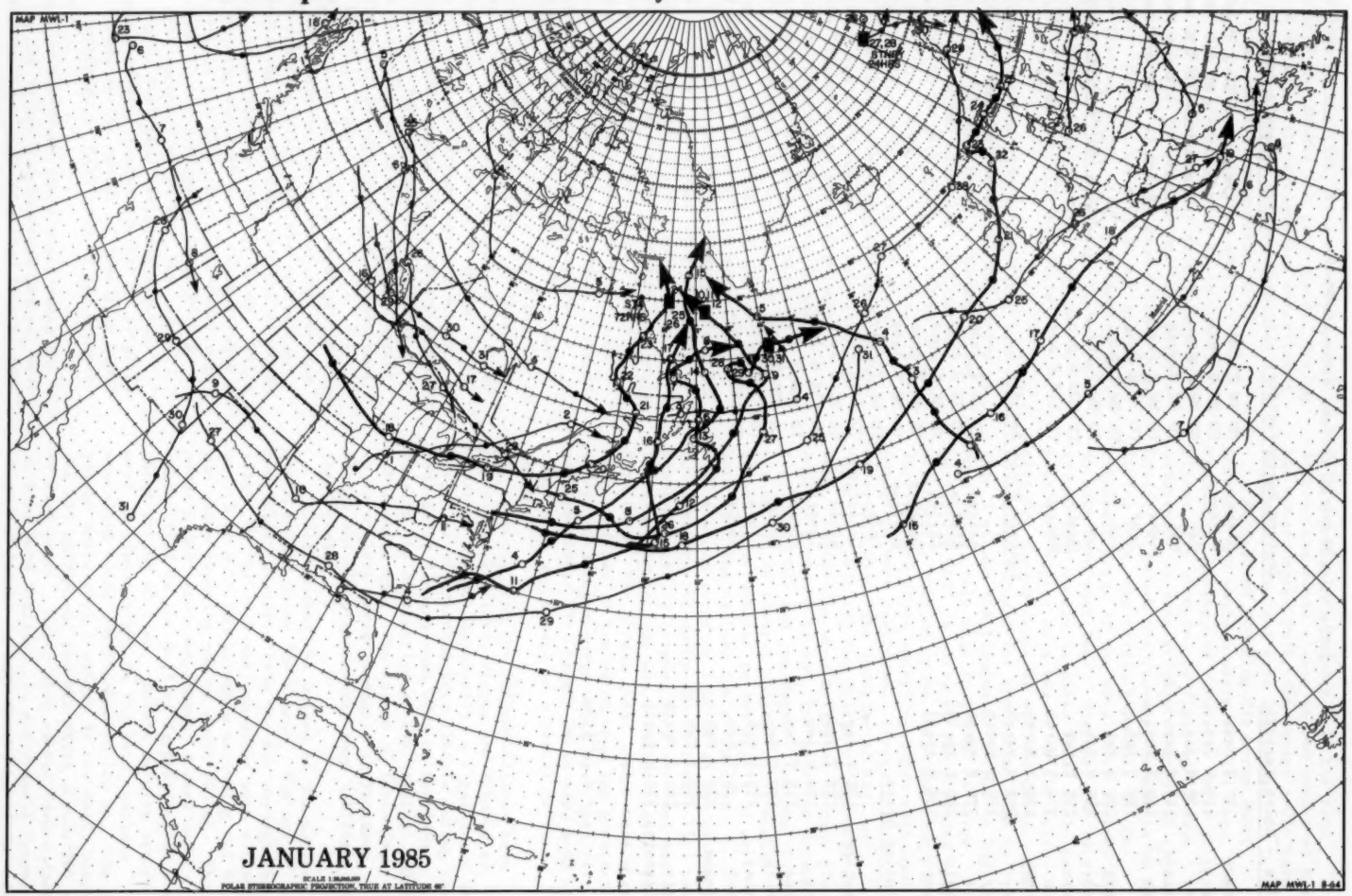
North Atlantic Ocean

Anna	TD 1	T	July
Bob	TD 2	H	July
Claudette	TD 3	H	Aug.
Danny	TD 4	H	Aug.
Elena	TD 5	H	Aug.

North Indian Ocean

--	1B	T	May
--	2A	T	May

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic



Closed circle indicates 0000 and open circle 1200 GMT positions. Square indicates stationary center. Cyclone tracks marked with heavy line are described in the Weather Log.

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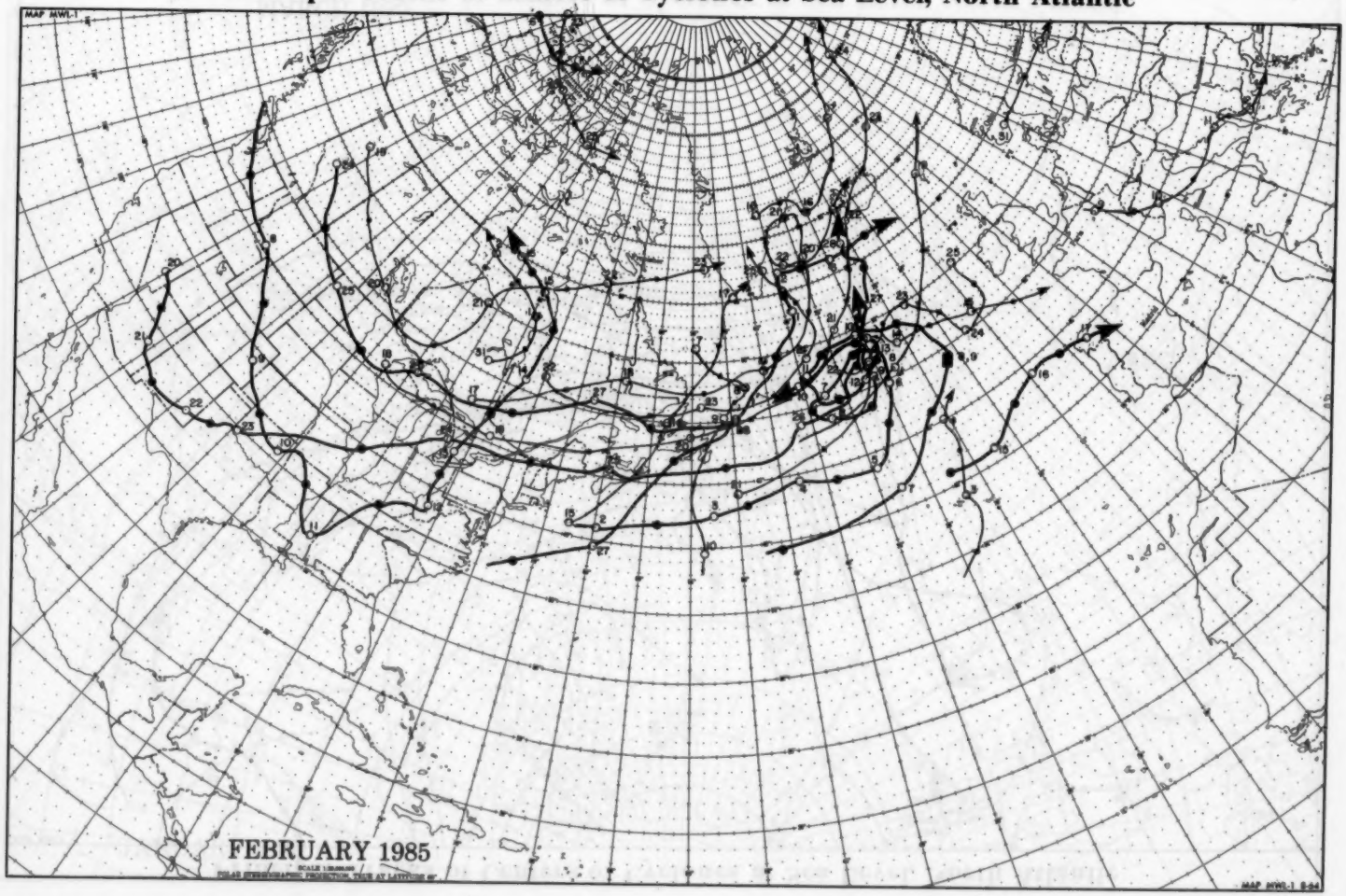
Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic



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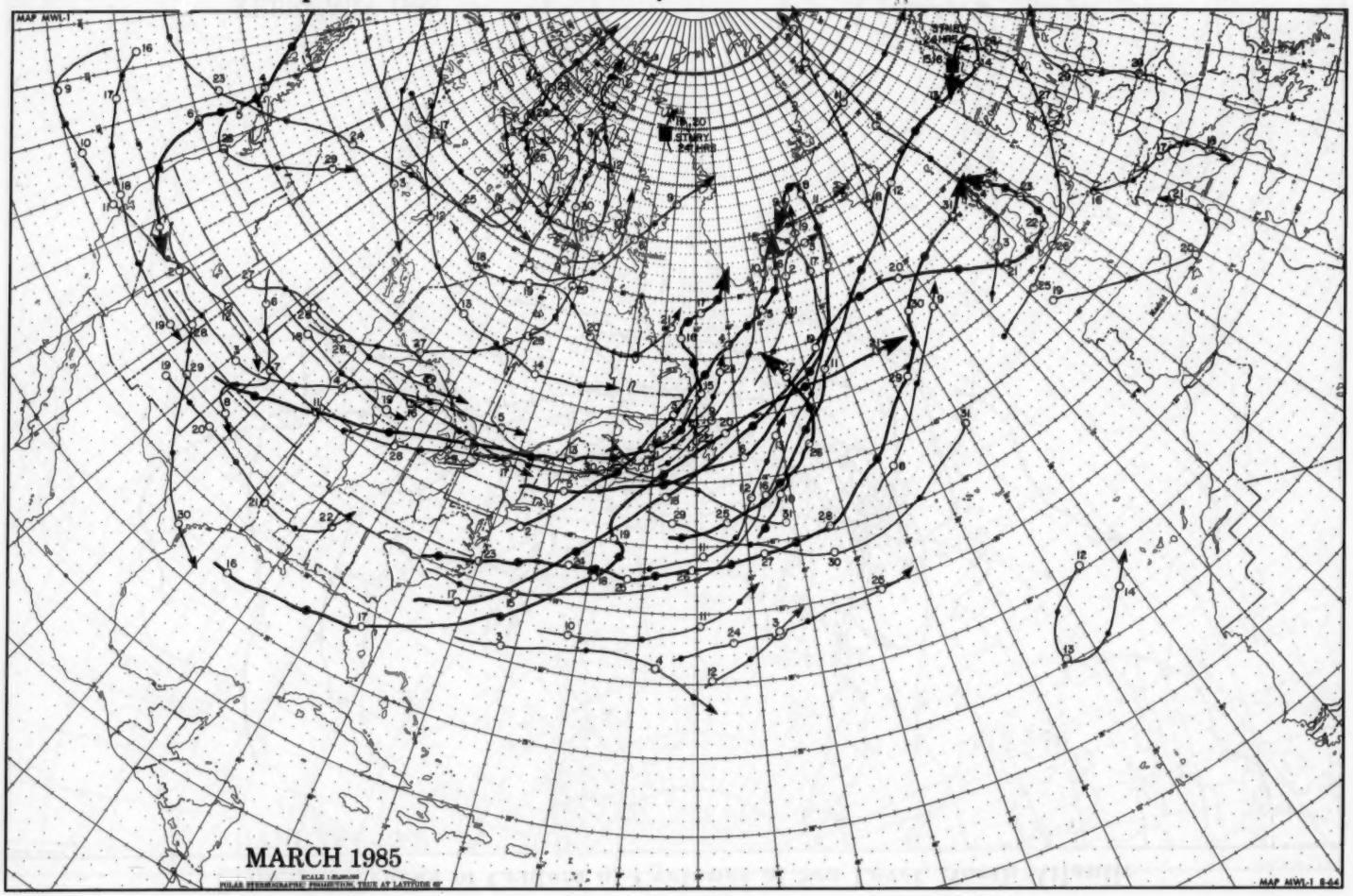
Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic



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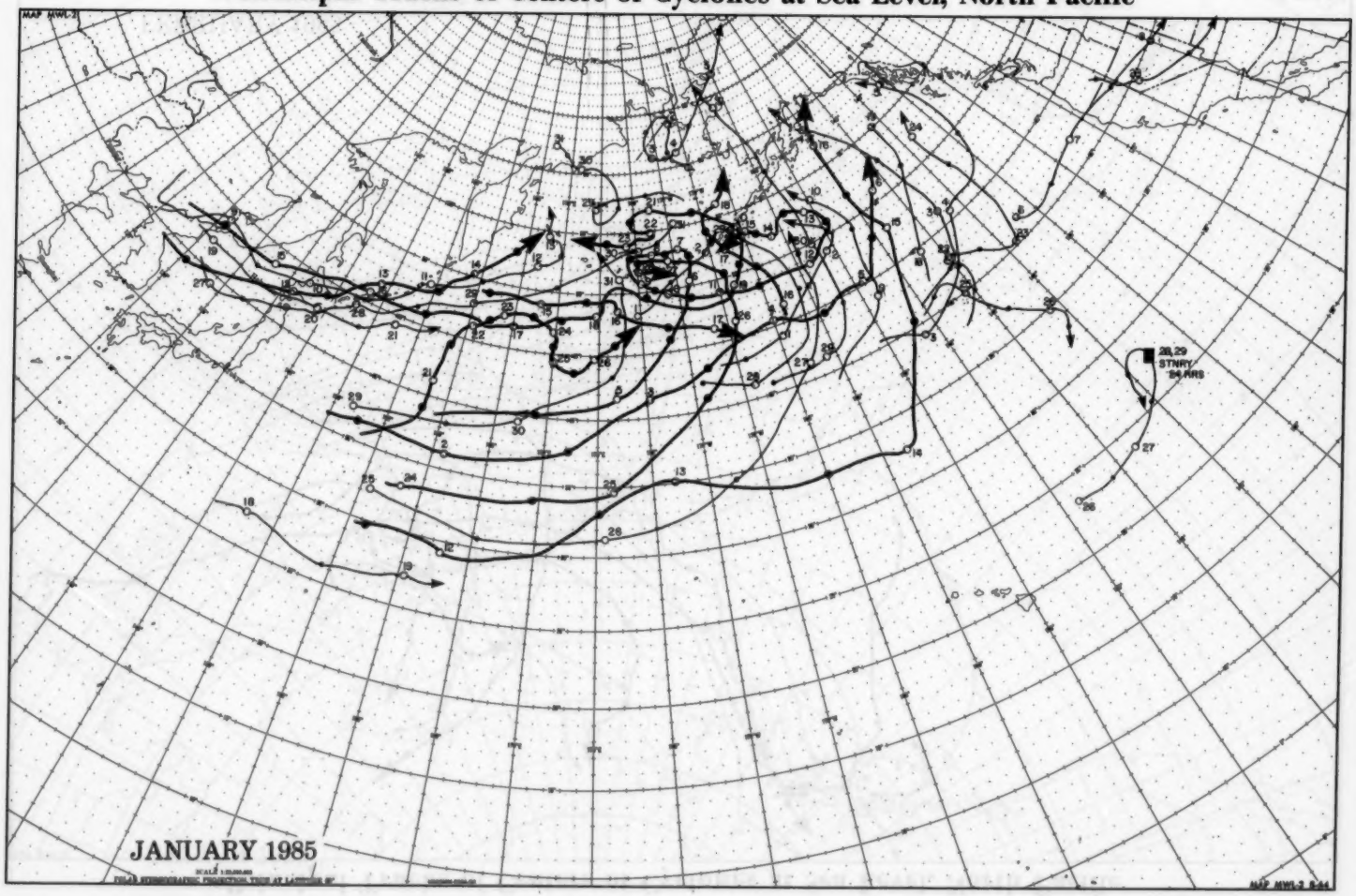
Principal Tracks of Centers of Cyclones at Sea Level, North Pacific



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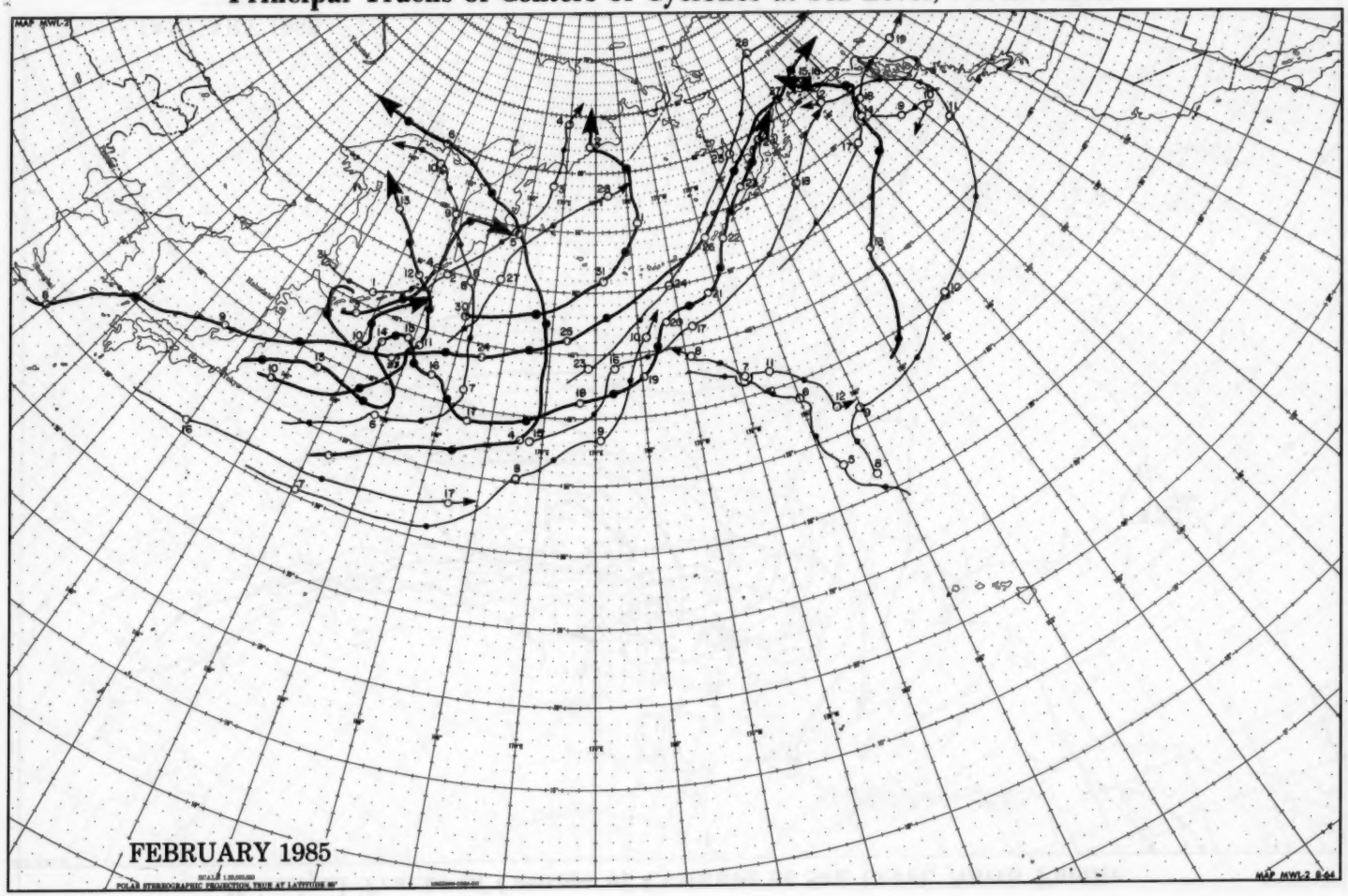
Principal Tracks of Centers of Cyclones at Sea Level, North Pacific



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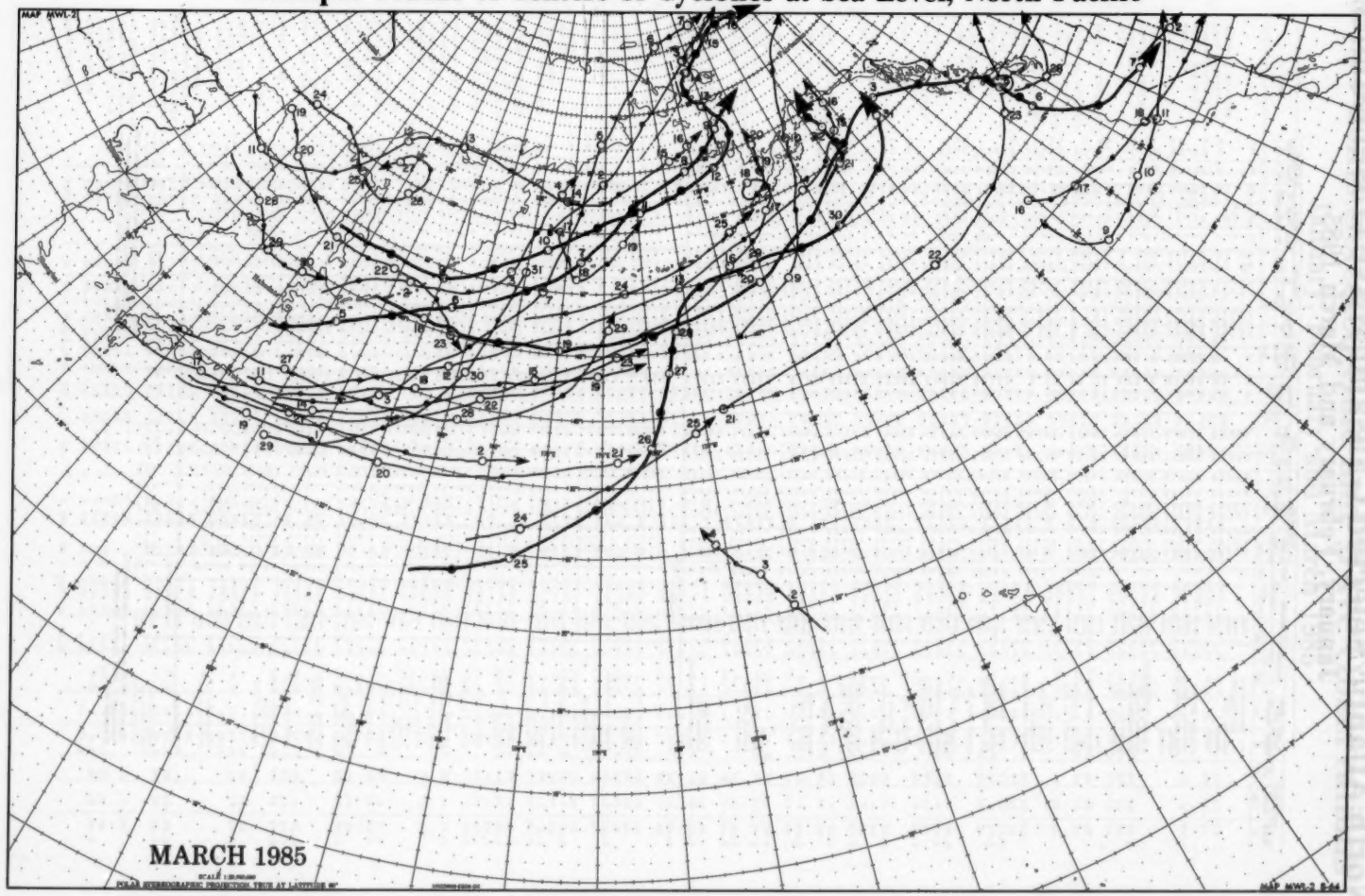
Principal Tracks of Centers of Cyclones at Sea Level, North Pacific



Closed circle indicates 0000 and open circle 1200 GMT positions. Square indicates stationary center. Cyclone tracks marked with heavy line are described in the Weather Log.

North Atlantic Selected Gale and Wave Observations
January, February and March 1985

Vessel	Nationality	Date	Position of Ship: Lat.	Long.	Time GMT	Wind: Direction	Force (Beaufort)	Visibility n. mi.	Present Weather code	Pressure mb	Temperature: °C Air	Sea	Sea Waves: Height m.	Period sec.	Swell Waves: Height m.	Period sec.	Direction Swell Waves
	ATLANTIC	JAN.															
TFL INDEPENDENCE	WYHK	2	43.9 N	30.7 W	18	32 N 50		.5 NM	61	0996.0	7.5	14.5	11	13	31	12	19.5
TFL INDEPENDENCE	WYHK	3	43.4 N	32.6 W	00	32 N 52				1001.5	6.0	15.0					
RAINBOW HOPE	KNDB	3	46.1 N	53.5 W	18	30	08			1004.0	1.1		4	14.5			
RAPID	WABJ	4	44.5 N	35.0 W	12	27	40	5 NM		0985.0	7.7	15.0	7	24.9			
RAPID	WABJ	5	45.3 N	35.5 W	06	30	45	5 NM	40	0990.0	4.4	14.5	6	13	28	10	29.5
SEALAND VOYAGER	KHPA	5	49.3 N	13.1 W	06	11 N 48		5 NM	02	1001.0	11.0	13.0	8	26	12	12	29.5
SEALAND LEADER	WSNH	6	39.9 N	53.2 W	12	27 N 57		5 NM	02	1005.0	12.5	20.0	8	19.5	27	22	26
SEALAND INDEPENDENCE	WDJC	7	42.7 N	40.3 W	06	29 N 46		10 NM	03	0999.0	12.0	14.0	4	6.5	30	7	8
RAPID	WABJ	7	48.5 N	22.0 W	12	12	50	10 NM	02	1006.0	12.2	14.5	5	11.5	12	11	29.5
ACADIA	ICDB	7	35.6 N	49.1 W	18	27	30	2 NM	19	1014.0	18.0	18.0	3	6.5	28	10	32.5
SEALAND INDEPENDENCE	WDJC	8	43.0 N	42.0 W	00	28 N 46		5 NM	02	1000.3	9.5	14.0	4	6.5	28	15	26
SEALAND LEADER	WSNH	8	40.1 N	63.7 W	19	28 N 60				0988.5	10.0	16.0	10	23	28	10	29.5
SEALAND EXPRESS	WDJD	9	41.1 N	52.1 W	06	28 N 46		10 NM	60	0992.0	13.0	16.0	9	24.5			
KENNETH E. HILL	COFA7	9	40.7 N	65.8 W	18	28 N 48		50 YD	04	1008.0	1.0		8	6.5	27	18	19.5
KENNETH E. HILL	COFA7	10	38.7 N	63.5 W	06	28 N 55		1 NM	68	1016.4	4.0	26.0					
ZEUS	PPFB	11	36.7 N	74.7 W	09	25 N 57		.5 NM	25	1016.4	15.0	12.0	8	11.5	06	5	4.5
EXPORT CHAMPION	WLCS	11	35.8 N	48.7 W	18	26	25	10 NM	21	1013.0	16.7	16.1	4	5	29	10	29.5
ZEUS	PPFB	12	38.1 N	74.4 W	00	17 N 58				1017.1	4.8	9.0	6	8	17	5	3
EXPORT CHAMPION	WLCS	12	35.9 N	54.3 W	12	26	50	2 NM	25		14.1	16.7	5	10	28	10	29.5
KENNETH E. HILL	COFA7	12	33.4 N	70.3 W	18	31 N 44		5 NM	61	1007.4	9.8	29.0	6	6.5	31	8	26
WALTER PICE	WCXE	13	35.0 N	69.3 W	18	32	50	10 NM	15	1007.9	12.2	20.6	8	10	30	12	16.5
EXPORT CHAMPION	WLCS	13	35.9 N	58.5 W	18	31	48	5 NM	25	0998.0	14.4	16.7	6	9	29	8	29.5
DOMINGUEN	WPCV	15	36.1 N	72.0 W	12	31	46			1007.0	7.8	23.3	5	6.5	31	6	13
EXPORT CHAMPION	WLCS	15	37.2 N	68.6 W	12	27	45	2 NM	25		10.0	17.8	5	13	29	12	29.5
	WPCS	15	38.3 N	59.8 W	18	26	50			0983.0	17.4	22.2	22	21	26	22	31
EXPORT CHAMPION	WLCS	16	37.5 N	69.4 W	00	33	35	2 NM	61	1002.5	7.2	17.8			33	22	29.5
EXPORT FREEDOM	WCJS	16	36.4 N	50.0 W	06	21	50	5 NM	03	0999.5	10.0	19.4	8	24.5	21	10	09
TFL INDEPENDENCE	WYHK	16	39.5 N	49.6 W	12	30 N 49		2 NM	99	0997.0	3.0	16.0	8	23	31	11	26
	KPSG	16	38.4 N	62.0 W	12	28	35	.25 NM	61	0999.0	6.7	21.7	22	24.5	30	22	31
EXPORT FREEDOM	WCJS	17	36.0 N	53.0 W	12	27	50	5 NM	25	1009.2	14.0	19.5	11	29.5	31	6	10
SEALAND LEADER	WSNH	17	38.5 N	47.7 W	18	28 N 50		5 NM	61	0997.5	12.0	18.0	8	14.5	28	11	19.5
RAPID	WABJ	18	36.7 N	38.7 W	12	26	25	10 NM	02	1006.5	14.9	20.0	5	6.5	28	10	29.5
SEALAND CONSUMER	WCXF	18	38.9 N	39.4 W	12	28	40	10 NM	01	1005.0	17.6	16.7	10	16.5	28	10	29.5
EXPORT FREEDOM	WCJS	18	36.5 N	56.6 W	15	25	45	1 NM	21	0993.5	16.7	19.4	10	29	25	10	29
TFL INDEPENDENCE	WYHK	20	42.9 N	32.1 W	06	29 N 48		5 NM	00	0986.5	12.0	14.5					
AMERICAN HERITAGE	WYFH	20	53.8 N	14.2 W	18	04 N 50		2 NM	63	0978.1	6.7	10.0	5	19.5	06	10	41
DOVER	WRDS	21	40.6 N	18.7 W	12	27	45	10 NM	25	0992.0	17.8	12.8	6	21	27	10	29.5
TFL LIBERTY	WYPD	21	43.9 N	62.1 W	18	26	50	2 NM	72	0985.0	- 2.0	5.0					
SEALAND EXPRESS	WDJD	22	43.6 N	57.1 W	00	23 N 50		5 NM		0986.0	1.0	6.0	8	16.5	29	9	19.5
DOVER	WRDS	22	39.8 N	16.2 W	00	32	25	10 NM	01	0995.7	14.3	14.0	6	16.5	27	10	29.5
SEALAND PIONEER	WSVB	22	34.7 N	68.8 W	12	26	37	5 NM	19	1008.0	9.0	18.0	6	10	28	9	26
MARATHA SHOGUN	ATYE	22	36.9 N	68.6 W	12	27	55	2 NM	96	1002.5	7.0	16.0					
BALTIMORE TRADER	WATJ	24	32.4 N	79.4 W	06	29	36	10 NM		1012.2	12.2	19.4	10	24.5			
	WDYE	24	34.4 N	54.3 W	06	23	15	10 NM	18	1013.6	18.4	16.5	6	3	29	12	29.5
TFL FREEDOM	WYXX	24	46.8 N	32.4 W	18	30 N 36		2 NM	62	0999.0	12.8	14.0	10	24.5	29	8	16.5
ARMAND HAMMER	GZVL	27	32.2 N	56.1 W	01	22	47	2 NM	97	0999.4	18.0	19.0	8	24.5	23	8	29.5
DOCTOR LYKES	WHKB	27	27.9 N	64.9 W	06	31	45	5 NM	00	1015.0	16.7	20.0	9	24.5			
TFL EXPRESS	WYFU	27	37.5 N	51.9 W	12	25 N 48		5 NM	01	0992.5	12.0	21.0	7	6.5	26	10	16.5
	WHMZ	27	49.7 N	17.0 W	12	29 N 20		10 NM	03	0999.0	10.0		6	16.5	29	7	26
	CGDE	27	33.7 N	53.7 W	12	27 N 49				1008.4	14.0		10	14.5	26	12	16.5
ROVER	WRDS	27	27.0 N	57.9 W	12	30	30	10 NM	01	1010.2	21.0	22.7	6	10	30	10	29
GAMA SETAN	TEYY	27	41.1 N	53.6 W	18	29	48	5 NM		0997.0	7.0	12.0	12	19.5			
RAINBOW HOPE	KNDB	27	52.6 N	40.9 W	18	19	55	3 NM	45	0955.1	4.7		7	10	10	6	29.5
GAMA SETAN	TEYY	28	40.4 N	58.6 W	00	29	48	5 NM		1000.1	15.0	15.0	8	16.5			
	WHMZ	28	49.3 N	27.5 W	12	22 N 44		10 NM	27	0993.0	12.0	15.0	5	16.5	22	8	29
TFL EXPRESS	CGTE	28	36.4 N	66.1 W	12	29	35	10 NM	01	1010.0	17.0	20.5	5	10	29	7	26
RAINBOW HOPE	WYFU	28	35.6 N	58.0 W	18	26 N 48		5 NM		1004.6	16.3	20.4	10	23	26	8	29.5
	KNDB	29	48.2 N	41.1 W	18	20	45	.25 NM	78	0964.0	2.2	3.0	10	22	7	7	32.5
SEALAND INDEPENDENCE	WDJC	30	49.2 N	42.0 W	06	27 N 33		10 NM	02	1002.0	7.0	14.0	5	6.5	29	13	26
	WDYE	31	41.2 N	41.0 W	06	19	30	10 NM	01	1003.2	11.7	19.4	5	11.5	19	12	26
	ATLANTIC	FEB.															
	TLTN	2	40.8 N	28.0 W	06	16 N 48		5 NM	07	1021.0	15.5						
	KSFO	4	47.5 N	20.2 W	00	13	50	5 NM	15	1024.5	13.5	15.6	6	10	13	8	19.5
ALMERIA LYKES	WDDU	4	42.1 N	27.5 W	00	33	56	2 NM	62	0986.1	9.1	13.0					
THAMES	AZCA	4	47.5 N	29.4 W	12	24 N 08				0973.0		17.0	3	5	11	6	29.5
AMERICANA	IBPA	4	38.4 N	41.7 W	16	29	40	2 NM	16	0988.0	16.0	18.0	17	29.5			
EXPORT CHALLENGER	WLSG	4	37.5 N	45.2 W	18	28	55	1 NM	27	0997.6	12.2	17.8	4	6	28	8	44
THAMES	AZCA	5	41.8 N	32.8 W	18	18 N 57		7 NM	6C	0978.0		19.0	7	13	22	7	29.5
AMERICANA	IBPA	5	38.4 N	42.6 W	18	30	50	1 NM	97	0999.0	6.9	18.0	15	29.5			
LICA MAERSK	GKPS	5	38.0 N	46.5 W	12	32	55	2 NM	16	1008.0	9.5		15	19.5	31	15	19.5
KENNETH E. HILL	COFA7	5	35.9 N	51.4 W	18	30 N 23		10 NM	16	1016.4	11.5	18.0	6	10	32	10	29.5
LASH ATLANTICO	WE7U	5	36.3 N	74.8 W	18	27	45	2 NM	82	0991.0	12.9	18.0	6	16.5	28	10	29.5
AMERICANA	IBPA	6	38.4 N	43.6 W	00	31	40	2 NM	61	1001.0	6.0	17.0	15	32.5			
ALMERIA LYKES	WDDU	6	36.1 N	31.6 W	06	27	63	5 NM		0993.1	11.1	19.4					
ATLANTAT	WFTV	6	36.6 N	74.9 W	06	30	60	2 NM	16	0995.7	8.7	17.8	5	16.5	28	10	42.5
LICA MAERSK	GKPS	6	37.3 N	40.3 W	06	28	50	5 NM	27	1003.0	7.0		12	19.5	28	15	23
THAMES	AZCA	6	40.9 N	33.4 W	17	32 N 28		5 NM	03	0977.0		19.0	4	11.5	30	8	29.5
JOSEPH LYKES	WHTB	6	32.6 N	73.0 W	12	29 N 40		10 NM	80	1006.0	15.0	18.0	5	14.5	29	8	26
ATLANTAT	WFTV	7	36.7 N	73.7 W	06	26	45			0995.9	11.7	17.2	4	13	28	7	29.5
	KEWZ	7	38.1 N	71.4 W	12	28	45	2 NM	62	1010.5	6.7	7.2	5	16	28	7	29.5
ALMERIA LYKES	WDDU	7	34.4 N	34.3 W	12	23	56	4 NM		0998.0	17.2	17.0	7	32.5	28	13	13.5
KENNETH E. HILL	COFA7	7	39.6 N	59.7 W	18	29 N 29		10 NM	21	0990.6	9.5	16.0	8	10	28	12	26
CHASTINE MAERSK	CUOH	8	48.9 N	11.7 W	12	14 N 41		1 NM	61	0995.9	14.8		12	32.5	14	11	19.5
SEALAND EXPRESS	WDJD	8	49.6 N	23.0 W	18	27 N 58		.25 NM	90	0964.9	5.8	11.0	11	29.5			
SEALAND VOYAGER	KHPA	8	40.6 N	69.2 W	18	28	58	5 NM	07	1001.2	- 4.0	4.0	3	10	28	5	13
AMERICAN SKY	WPPR	9	38.2 N	68.5 W	00	32	42	5 NM	28	0995.0	5.8	17.2	4	19.5	31	7	26
KENNETH E. HILL	COFA7	9	32.9 N	71.5 W	06	30 N 58		5 NM	25	1016.0	0.0	13.0			34	10	19.5
RAINBOW HOPE	KNTB	9	50.5 N	69.4 W	06	29	35	2 NM	74	1013.0	- 1.1		5	11.5	29	7	29.5
KENNETH E. HILL	COFA7	9	44.4 N	27.1 W	18	26 N 45		5 NM	81	0999.2	9.2	13.2	15	32.5			
AXEL JOHNSON	SMPN	10	39.2 N	69.2 W	18	29	40	2 NM	16	0996.4	10.0	19.2	14	29.5			
LASH ATLANTICO	WE7U	9	36.0 N	53.1 W	18	27	50	2 NM	91	0998.0	12.2	16.3	6	10	27	8	16.5
	CUOH	10	48.2 N	17.0 W	00	25 N 41		2 NM	81	0987.5	11.5		10	32.5	25	10	32.5
ATLANTAT	WFTV	10	37.5 N	73.4 W	00	31	46	2 NM	80	0993.0	9.2	18.9	6	26	29	10	36
AXEL JOHNSON	SMPN	10	35.2 N	67.2 W	00	30	55			0998.0	10.0	19.6	14	32.5			
LASH ATLANTICO	WE7U	10	36.0 N	53.8 W	00	27	50	2 NM	91	0994.2	12.2	16.3	7	13	27	8	16.5
CHASTINE MAERSK	CWCY	10	37.1 N	40.1 W	18	25	35	2 NM	80	0993.0	16.3	18.0	9	10	26	9	32.5
CHASTINE MAERSK	CWCY	11	37.5 N	44.7 W	18	26	30	1 NM	61	1006.1	15.2		6	10	26	6	29.5
	WE7U	12	37.6 N	75.5 W	12	28	50	5 NM	13	0997.5	11.9		3	6.5	16	6	19.5
	WPCV	12	37.0 N	73.2 W	12	17	50	5 NM	02	1007.0	14.1	21.7	6	11.5	17	8	16.5
SAND STORM	TLTT	12	34.3 N	67.5 W	18	33 N 34		5 NM	02	1013.0	14.0	24.0	13	31	33	12	26
USCRC DEXIE (WMTC 37)	WDTG	12	36.0 N	76.7 W	22	15 N 44				1012.0	16.7	19.4	8	10	15	12	21
SAND STORM	TLTT	13	34.7 N	68.3 W	00	32 N 30		10 NM	01	1027.0	14.0	24.0	13	36	32	12	31
SEALAND VOYAGER	KHPA	13	40.5 N	66.8 W	06	15	57	2 NM	60	1011.8	15.0	10.0	10	23	14	10	23
	CUOH	14	42.9 N	40.6 W	12	23 N 41		2 NM	05	1021.0	11.0	23.0	12	32.5	14	11	19.5
	CUOH	16	41.7 N	47.7 W	00	23 N 22				1024.0	10.0	24.0	13	29.5	17	10	19.5
	CUWS	26	42.2 N	38.1 W	00	19 N 43		2 NM	61	1036.0	15.8	15.0	8	14.5	20	16	16.5
	CUVS	27	44.2 N	30.6 W	00	21 N 60		2 NM	60	0984.0	11.5	13.0	12	37.5	21	15	36.5
SEALAND VOYAGER	KHPA	27	42.0 N	44.0 W	00	22	42	10 NM	01	1033.0	16.0	16.0	7	19.5	32	7	26
AMERICAN PIONEER	WSPL	27	37.3 N	52.0 W	00	36	25	10 NM	01	1029.0	10.4	18.9	7	13	36	8	29.5
	CUVS	28	46.9 N	18.3 W	12	30 N 43		5 NM	03	1011.2	7.0	12.0	6	23	29	14	36
RAINBOW HOPE	KNCB	28	41.6 N	57.2 W	18	30	35	10 NM	02	1020.0	7.8	10.0	4	8	29	7	29.5
	ATLANTIC	MAR.															
OTHI SAGERAM	CUVS	9	44.2 N	28.0 W	06	27 N 43		2 NM	90	1022.0	10.0	12.0	6	14.5	23	10	29.5
OTHI SAGERAM	CUVS	13	40.4 N	63.6 W	18	25 N 48		2 NM	64	1000.5	12.8	16.8	18	23	26	22	29.5
NATHELBE MAERSK	WRKE	18	40.5 N	59.2 W	18	20	50			1001.8	20.8		5	10	28	17	29.5

+ Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
N Measured wind

NOTE: The observations are selected from those with winds 2 40 kn or waves 2 20 ft from April through September and 45 kn or 30 ft October through March.

North Pacific Selected Gale and Wave Observations

January, February and March 1985

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10's	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb	Temperatures °C Air	Temperatures °C Sea	Sea Waves? Period sec.	Sea Waves? Height ft.	Swell Waves Dir. 10's	Swell Waves Period sec.*	Swell Waves Height ft.
	PACIFIC	JAN.															
NEPTUNE DIAMOND	9VYT	1	40.9 N	173.0 W	00	29	N 48	5 NM	50	0991.5	5.0	9.7	9	13	31	12	25
STAR CARRIER	D5PC	2	44.0 N	176.7 E	00	27	N 23	5 NM	02	0998.0	4.0	9.0	10	26	09	10	21
HOEGH MIRANDA	LIOZ	2	43.0 N	161.4 E	00	32	N 50	10 NM	02	1006.3	0.2						
MOBIL MERIDIAN	KGSM	2	54.6 N	135.6 W	06	14	30	2 NM	51	1018.0	7.8	6.7	2	8	22	6	24.5
VAN HAWK	D5ZU	3	43.8 N	178.9 E	18	36	N 65	1 NM	84	0993.0	2.0	1.0	8	16.5			
MIXTECO	ABCD	4	40.8 N	179.5 W	00	30	N 60	.25 NM	94	0995.0	5.0	3.0					
MIXTECO	OXYZ	4	37.7 N	164.3 W	18	28	45	5 NM	18	0998.0	10.0	14.0	14	26			
SEALAND EXPLORER	WGJF	4	32.0 N	167.6 W	18	31	N 42	5 NM	80	1017.5	14.0	17.0	10	24.5	XX	10	24.5
EVER VISOR	BMCN	4	33.0 N	168.5 W	23	20	N 24	10 NM	01	1018.0	15.5	18.0	3	6.5	27	10	26
MIXTECO	OXYZ	5	37.6 N	164.8 W	00	27	N 46	5 NM	81	1005.0	13.0	14.0	12	32.5	27	10	13
SEALAND EXPLORER	WGJF	5	32.2 N	168.0 W	00	31	N 24	10 NM	01	1019.6	18.0	19.0	10	24.5	31	10	28
ORIENTAL.EXPLORER	BMCN	5	27.3 N	168.9 W	06	06	N 14	10 NM	02	1022.5	18.0	22.0	5	6.5	31	10	26
EASTERN GRACE	3EGX3	5	41.2 N	162.2 E	12	30	N 48	2 NM	90	0985.5	5.0						
ORIENTAL EXPLORER	BMCN	6	39.3 N	151.8 W	20	29	N 36			1006.0	12.0	16.0	4	13	29	10	26
		6	40.5 N	167.2 E	00	27	N 55	.25 NM	45	0986.0	5.0						
NATIONAL DIGNITY	DZRG	6	39.7 N	176.4 E	06	26	N 46	2 NM	20	0983.0	9.0	10.0	10	14.5	26	16	26
KENAI	WSNB	6	56.8 N	141.5 W	06	12	N 60	5 NM		1007.4	4.4	4.4	XX	10	12	XX	10
EVER SUPERB	HONF	6	48.9 N	173.5 W	09	16	N 51	.5 NM			4.0	7.0	12	18	17	13	19.5
SANKO AZALEA	3ELB2	7	38.9 N	170.6 W	00	27	N 55	10 NM	15	0983.5	10.5	13.0	7	19.5	18	8	29.5
ARCTIC TOKYO	5LJT	7	53.2 N	172.5 E	18	36	N 50	1 NM	55	0968.0	3.0	3.0	8	19.5	06	14	26
EVER SUPERB	HONF	7	46.8 N	178.6 E	18	27	N 51	1 NM	27	0970.0	1.0	7.0					
EVER VITAL	BMCL	8	37.3 N	148.5 W	00	25	N 37	10 NM	01	1003.0	16.0	15.0	14	24.5	25	14	24.5
	DUKY	8	52.7 N	171.4 E	00	35	N 50	.5 NM	84	0971.0	0.0	9.0	2	6.5	02	9	16.5
ARCTIC TOKYO	5LJT	8	51.4 N	168.5 E	04	33	N 50	.25 NM	59	0980.0	1.0	3.0	8	13	01	12	23
NATIONAL DIGNITY	DZRG	8	39.7 N	167.4 W	06	27	N 44	5 NM	00	0985.9	10.0	11.0	10	10	25	12	24.5
EVER SUPERB	HONF	8	45.0 N	175.1 E	18	28	N 54			0982.5	2.5						
	WSTS	8	44.9 N	177.9 W	18	28	N 38	10 NM	27	0972.0	2.2	6.7	8	8	29	11	29.5
	3FGZ2	8	48.4 N	131.5 W	23	14	N 27	1 NM	58	1002.0	9.0	8.8	14	29.5	14	7	10
SANKO AZALEA	3ELB2	9	38.5 N	157.9 W	00	17	N 08	10 NM	00	0988.5	12.0	13.0	2	5	23	9	26
EVER VITAL	BMCL	9	36.7 N	155.4 W	00	20	N 36	5 NM	03	0996.0	17.0	16.0	15	24.5	22	15	24.5
ANJA LEONHARDT	DVIU	9	40.0 N	178.2 E	06	32	30	10 NM	89	0995.5	4.0		6	10	38	8	24.5
TABASCO	5BDV	9	42.9 N	171.6 W	06	27	N 31	10 NM	03	0982.5	4.5	8.0	XX	32.5	26	XX	16
EXXON HOUSTON	DXFU	9	54.1 N	161.2 W	12	19	N 50	5 NM	81	0972.5	9.0		8	19.5			
	KWRA	9	57.4 N	141.9 W	22	15	N 34			1008.8	7.0	5.6	3	8	15	7	24.5
MIXTECO	OXYZ	10	35.8 N	170.0 E	18	32	30	5 NM	81	1013.0	11.0	14.0	8	13	34	12	26
SANKO AZALEA	3ELB2	11	36.7 N	145.2 W	00	27	N 17	10 NM	01	0999.9	14.0	16.0	3	6.5	19	12	29.5
CONDORA	ELAK7	11	38.8 N	177.9 W	00	30	N 31	5 NM	80	0999.0	4.0	12.0	10	24.5	30	11	24.5
EVER SHINE	HPTT	11	43.0 N	176.1 E	00	30	N 49	2 NM		0998.0	4.0	7.0					
CHEVRON MISSISSIPPI	WXER	11	53.2 N	136.2 W	06	16	40	2 NM	62	1000.3	7.8	6.7			16	6	32.5
MARGARET LYKES	KRJL	12	29.0 N	168.9 W	00	31	40	10 NM	01	1010.2	18.3	18.0	8	8	29	12	24.5
ANJA LEONHARDT	5BDV	12	46.4 N	152.9 W	12	14	N 58	50 YD	18	0986.4	7.1	7.0	XX	26	13	XX	28
EXXON HOUSTON	KWRA	12	48.1 N	138.0 W	21	15	N 17			1031.8	1.0	7.2	3	6.5	13	10	24.5
NEONIA	DXON	13	51.9 N	145.1 W	00	09	N 56	.25 NM	53	0991.2	6.6		9	23			
GALVESTON	KBGA	13	54.5 N	138.5 W	06	13	N 50	5 NM		1004.0	5.6	5.6	6	16.5	12	12	24.5
CHARLES LYKES	KLMR	13	30.0 N	174.5 E	12	29	50	10 NM	01	1005.0	16.7	15.6	2	13	30	5	13
PRESIDENT TYLER	WEZN	14	40.9 N	146.8 E	00	29	N 50	5 NM	26	0999.0	0.5	8.0	7	16.5	28	10	28
GREEN WOOD	3FRB2	14	42.2 N	154.3 E	06	28	N 40			0992.0	2.0	8.0	10	19.5	27	10	28
PHOENIX	PKCJ	14	40.0 N	150.9 E	12	31	N 49	5 NM	02	1000.0	4.0	12.0	7	11.5	31	12	13
SHELDON LYKES	KRJP	14	48.1 N	136.5 W	12	25	48	5 NM	07	0999.1	9.2	9.5	8	23	24	12	16.5
EVER LAUREL	BKMN	14	40.3 N	154.9 E	18	27	N 50	5 NM	03	0994.5	1.0	5.5	9	8	34	11	13
CONDORA	ELAK7	14	38.8 N	148.3 W	18	13	N 40	5 NM	64	0995.0	15.0	15.0	9	24	17	10	28
CONDORA	ELAK7	15	39.1 N	147.1 W	00	17	N 36	.5 NM	62	0984.0	16.0	15.0	8	32.5	16	9	32.5
NEWARK	WNTO	16	58.7 N	150.2 W	00	04	N 48	2 NM	61	0989.4	3.4	6.1	5	8	10	14	10
EVER LAUREL	BKMN	16	43.5 N	169.6 E	06	28	N 58	2 NM	40	0981.5	1.5	3.0	9	11.5	29	10	16.5
SOHIO RESOLUTE	KACN	16	56.8 N	148.5 W	18	23	45			0976.0	4.4	5.4	9	24.5	23	10	32.5
SEALAND FREEDOM	WGJN	16	40.5 N	179.1 W	18	27	N 50	5 NM	26	0978.0	7.0	10.0	4	14.5	27	9	32.5
EVER VALIANT	HOMH	17	42.4 N	178.7 W	00	28	N 50			0974.5	7.0	10.0	8	19.5	26	12	32.5
PRESIDENT LINCOLN	KDBS	17	44.6 N	152.8 W	06	16	N 20	5 NM	02	0991.2	6.7		8	18	XX	11	24.5
SHELDON LYKES	KRJP	17	51.4 N	163.5 W	06	22	52	.5 NM	62	0959.5	4.4	6.0	5	10	17	10	19.5
SOHIO RESOLUTE	KACN	17	53.5 N	149.2 W	12	19	45			0995.7	5.5	5.0	7	16.5	19	8	24.5
SEALAND PATRIOT	KHRF	17	35.8 N	150.6 E	12	34	N 30	10 NM	26	1012.0	11.0	16.0	6	6.5	29	14	24.5
SKOUBORD	LION	17	37.1 N	156.4 E	12	27	N 49	5 NM	03	1003.0	8.0	13.5					
SEALAND PATRIOT	KHRF	18	36.7 N	161.0 E	12	28	N 50	10 NM	00	1009.5	8.0	11.0	7	10	29	18	26
SKOUBORD	LION	18	37.4 N	162.7 E	12	30	N 52	5 NM	27	1006.5	3.0	12.0					
ORIENTAL EXECUTIVE	D5AN	19	36.1 N	155.9 E	12	33	N 50	5 NM	02	1017.0	8.5	13.0					
SOHIO RESOLUTE	KACN	19	41.1 N	152.2 W	12	20	65	.25 NM	07	0987.4	9.8	6.7	5	16.5	26	8	32.5
SEALAND PATRIOT	KHRF	19	37.5 N	171.0 E	12	28	N 64	5 NM	95	0998.0	8.0	12.0	8	10	28	20	32.5
OAK SUN	ELCF2	19	39.6 N	167.0 E	18	29	N 50			1001.0	2.0	5.0					
SOHIO RESOLUTE	KACN	20	42.5 N	152.4 W	00	22	24	10 NM	02	0999.8	10.0	7.8	7	13	23	10	26
HOEGH DENE	LMDS	20	37.0 N	172.3 W	00	26	N 33	5 NM	03	0995.0	10.0	11.0	6	14.5	27	12	24.5
ARCTIC TOKYO	5LJT	20	54.4 N	167.6 W	06	10	N 65	2 NM	84	0982.0	4.0	9.0	8	10			
QUATSINO SOUND	ELAW3	21	38.1 N	155.5 E	18	25	N 48	5 NM	88	0993.0	6.0		7	21			
EVER VALIANT	HOMH	22	34.8 N	148.8 E	00	29	N 38			1012.0	10.0	15.0	5	19.5	29	8	32.5
GREEN WOOD	KRJS	22	43.2 N	171.9 E	00	10	N 22	10 NM	01	1009.0	3.0	9.7	4	5	32	10	24.5
	3FRB2	22	49.7 N	139.8 W	12	14	N 50	50 YD	62	0993.0	4.0	7.3	15	29.5	14	15	29.5
QUATSINO SOUND	ELAW3	22	39.1 N	160.6 E	12	27	N 54	5 NM	88	0990.5	6.0		8	26			
	KRJF	22	50.9 N	137.6 W	18	18	N 40	2 NM		1000.2	8.9		7	11.5	18	12	26
GREEN WOOD	3FRB2	23	49.5 N	138.4 W	00	15	N 38	200 YD	62	0997.0	9.0	8.8	15	29.5	14	15	29.5
QUATSINO SOUND	ELAW3	23	48.5 N	166.9 E	12	27	N 58	5 NM	88	0992.5	5.0		8	32.5			
MAERSK WAVE	ELAH3	23	45.6 N	152.2 E	21	29	N 52	50 YD	75	0996.0	8.0		10	23			
MAERSK WAVE	ELAH3	24	45.0 N	151.3 E	00	29	N 45	5 NM	02	1001.0	- 2.0		11	31			
QUATSINO SOUND	ELAW3	24	41.2 N	170.4 E	00	24	N 45	5 NM	88	0987.5	7.0		8	29.5			
SEALAND EXPLORER	WGJF	25	37.0 N	167.2 E	18	30	N 40	10 NM	27	0994.0	8.0	13.0	10	24.5	30	10	24.5
SEALAND EXPLORER	WGJF	26	34.7 N	171.7 E	05	28	N 50	5 NM	27	0993.5	8.0	11.0	10	32.5	29	10	16.5
QUATSINO SOUND	ELAW3	26	48.7 N	171.6 W	12	22	N 56	10 NM	01	0970.4	5.0		6	16.5			
MELBOURNE HIGHWAY	3ERW2	26	54.2 N	175.5 W	23	05	N 40	50 YD		0976.0	3.0	5.0	5	5	15	7	26
CHARLOTTE MAERSK	OYIU	27	32.0 N	162.4 E	06	29	41	10 NM		1010.0	11.0		13	36			
PRESIDENT TYLER	WEZN	28	38.5 N	163.7 E	06	32	N 40	5 NM	26	1012.5	6.1	10.0	5	11.5	31	12	26
SAVONITA	DZJT	29	42.3 N	147.9 E	00	27	N 42	5 NM	26	0996.5	- 3.0	8.0	7	6.5	26	10	26.5
LEISE MAERSK	OXDW	30	54.1 N	163.9 W	00	19	48	2 NM	51	1000.7	6.0		12	29.5			
LUNA MAERSK	OWDX	30	43.2 N	152.7 W	12	13	52	1 NM	81	1007.1	11.2						

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10's	Wind Speed kts.	Visibility n. mi.	Present Weather code	Pressure mb	Temperature °C Air	Temperature °C Sea	Sea Waves? Period sec.	Sea Waves? Height ft.	Swell Waves Dir. 10's	Swell Waves Period sec.*	Swell Waves Height ft.
	PACIFIC	FEB.															
SANKO STORK	ELDI7	1	43.7 N	168.5 E	00	29	M 20	5 NM	22	1006.5	-1.5	4.0	8	19.5	28	12	24
MOEGH MIRANDA	LIOZ	1	54.2 N	168.3 W	03	16	M 50	1 NM	82	0995.0	6.0	5.3	5	19.5			
TOYOTA #24	5MTS	1	44.9 N	172.0 W	06	25	M 27	10 NM	15	1001.5	4.5	8.0	6	10	22	13	26
HARBOUR BRIDGE	D5MS	2	55.3 N	179.7 E	06	24	M 50	1 NM		0989.0	2.0	4.0	10	23	24	10	24.5
	WDZR	2	27.8 N	174.9 E	12	07	M 50	10 NM	00	1018.5	14.0	17.2					
SEALAND PATRIOT	KHDF	2	47.3 N	168.0 W	18	29	M 18	10 NM	15	1026.0	3.0	3.0	5	3	28	14	26
CORNUCOPIA	KPJC	2	47.2 N	158.3 E	18	25	M 42	10 NM	26	0987.4	- 3.3	-1.2	5	10	27	10	24.5
CORNUCOPIA	KPJC	3	46.5 N	157.4 E	00	25	M 40	10 NM	03	0995.6	- 3.3	1.4	5	11.5	26	9	24.5
HARBOUR BRIDGE	D5MS	3	53.6 N	172.0 E	06	23	M 42	2 NM	62	0989.5	2.0	5.0	8	13	23	8	24.5
	9MWN	4	34.4 N	172.1 E	06	18	M 23	5 NM	21	1008.0	15.0	17.0	5	14.5	16	9	24.5
POLAR ALASKA	5LFU	5	52.9 N	169.9 E	06	12	M 56	50 YD	09	0986.0	4.0	3.0					
ORIENTAL EXECUTIVE	D5AN	6	53.6 N	150.7 W	06	32	M 60	5 NM	02	1028.0	5.0	5.0	11	10	32	14	16.5
ALASKA STANDARD	WM7N	6	57.5 N	152.0 W	12	33	55	10 NM	00	1025.2	1.8	5.6	4	10	33	8	10
LARS MAERSK	OXMD	8	43.6 N	157.8 E	18	27	50	5 NM	02	1016.0	- 0.5						
PRESIDENT JOHNSON	WVHS	9	46.1 N	157.2 E	05	27	40	2 NM	86	1012.0	- 3.9	1.7	6	10	27	7	26
	KRJG	9	47.2 N	160.0 E	06	26	M 30	5 NM	26	1010.0	- 3.0		6	11.5	26	10	24.5
BAY BRIDGE	3EYN	9	37.0 N	143.8 W	21	14	M 50			1020.0	14.0	16.0	4	6.5	70	5	8
TAWASCO	DXFU	10	39.9 N	152.1 W	12	04	M 50	5 NM		0999.0	9.6	14.0	8	16.5			
ORIENTAL EXECUTIVE	D5AN	10	48.9 N	158.7 E	18	11	M 50	2 NM	75	1009.0	1.0	2.0					
KOREAN FIR	A8WW	11	42.2 N	161.7 E	00	14	M 37	1 NM	95	1003.5	8.0	5.0	6	16.5	13	13	26
	KRJF	11	41.7 N	161.6 E	06	15	M 37	.5 NM	52	0994.4	8.3		15	26			
GREAT LAND	WFPP	11	58.9 N	151.4 W	12	04	M 50	.25 NM	73	1002.8	- 1.1	6.7	5	8	04	8	16.5
ORIENTAL EXECUTIVE	D5AN	11	41.9 N	152.6 E	18	27	M 52	.5 NM	68	0985.0	3.0	2.0	10	8	11	11	13
APCO ALASKA	KSFK	11	46.3 N	130.2 W	18	26	M 43	2 NM	07	1003.1	7.5	5.5	4	13	19	8	32.5
	WSXN	11	47.8 N	125.2 W	18	18	50	.5 NM	81	1000.1	10.0	10.0	4	6.5	20	8	24.5
	WSYN	12	47.3 N	124.0 W	00	28	40	10 NM	01	1012.0	7.8	10.0	4	6.5	22	11	29.5
EVER LIVING	RKMG	12	42.6 N	151.6 W	18	17	M 28	2 NM	61	1006.5	10.0	9.0	5	16.5	17	6	26
SHELDON LYKES	KRJP	13	34.3 N	164.8 W	00	35	48			1005.2	11.7	15.0	6	16.5	34	9	24.5
EXXON PHILADELPHIA	WNFJ	14	49.2 N	133.5 W	00	14	M 52	.5 NM	10	1002.0	9.5	7.8	7	10	16	12	14.5
OCTA	A8QG	14	48.8 N	152.7 E	12	09	M 48	< 50 YD	07	0972.0	3.0	0.0	8	19.5	09	7	19.5
GOLDEN HAWK	DULL	14	53.9 N	179.9 W	23	29	M 48	2 NM	26	0983.5	3.5	5.0	5	11.5	29	7	31
	H3XV	14	52.5 N	135.4 W	23	25	M 57	1 NM	12	0988.0	3.0	6.5	12	23			
	KRDB	15	54.8 N	139.4 W	00	29	54	1 NM	69	0981.7	1.7	10.0	6	26			
FIGARO	SIPA	15	49.9 N	132.4 W	00	22	M 50	2 NM	88	1007.0	6.8	9.0	16	23	22	14	16.5
HANJIN CHEJU	3EVP2	15	42.5 N	162.6 E	06	27	M 23	10 NM	07	0990.0	5.0	7.0	12	26	15	15	26
MOBIL MERIDIAN	KDSM	15	55.7 N	176.1 W	06	23	50	.25 NM	22	0992.0	2.8	5.5					
MOBIL ARCTIC	KSPY	15	50.6 N	133.9 W	06	25	52	2 NM	07	1011.8	4.4	6.1	3	6.5	25	10	26
EASTERN FRIENDSHIP	H8LR	15	35.9 N	151.3 E	18	28	M 50	2 NM	93	0996.0	6.0	7.5	6	11.5	28	6	19.5
EXXON LEXINGTON	KIYP	15	14.1 N	96.2 W	18	03	M 35	10 NM		1013.0	25.3	22.2	5	16.5	06	7	24.5
PRESIDENT GRANT	WE7D	15	35.0 N	151.5 E	18	29	50	10 NM	13	0997.5	7.3	15.6	10	19.5	25	14	24.5
BROOKS RANGE	KSFP	15	54.5 N	138.9 W	18	25	35	10 NM	27	1007.0	2.3	5.6	7	19.5	19	9	24.5
GOLDEN HAWK	DULL	15	53.9 N	144.1 W	23	24	M 37	5 NM	03	1006.1	3.0	4.0	6	11.5	28	9	24.5
BRIGHT SUN	H3AG	16	52.3 N	167.7 E	06	07	M 32			1007.0	3.5	5.5	10	26	07	10	26
GOLDEN HAWK	DULL	16	54.0 N	146.5 W	12	28	M 44	5 NM	20	1007.0	1.8	4.1	6	11.5	28	9	24.5
PRESIDENT TYLER	WE7M	16	48.5 N	168.6 E	18	07	M 30	1 NM	50	0998.0	3.3	1.7	4	16.5	09	10	26
MOEGH DRAKE	LMOU	17	30.2 N	162.0 E	12	22	M 60	5 NM	03	0997.0	19.0	19.0	9	19.5			
FIGARO	SIPA	17	50.2 N	150.3 W	12	24	M 48	2 NM	80	0997.0	5.4	6.0					
PRESIDENT TYLER	WE7M	17	45.9 N	160.5 E	12	08	M 32			1002.3	2.2	2.2	4	11.5	05	15	29.5
EVER SUMERB	HOKF	19	39.8 N	169.5 E	00	34	M 44	1 NM	50	0981.0	6.0	12.0	14	24.5	35	14	26
GOLDEN HAWK	DULL	19	54.0 N	172.4 W	18	06	M 49	.25 NM	43	0999.5	6.5	3.0	5	8	06	9	19.5
USNS DE STEIGUER	NAEE	21	39.1 N	174.3 W	23	34	M 43	5 NM	00	1018.0	10.0	11.1	6	16.5	33	10	24.5
	VJWH7	21	54.2 N	170.0 W	23	08	M 54	700 YD	22	1004.0	- 2.0	5.0	19	14.5	04	19	24.5
USCGC MIDGETT (WHEC 726)	NMWR	22	52.9 N	171.2 W	12	02	M 51	.5 NM	71	0992.5	- 2.6	1.1	9	8	03	0	21
PRESIDENT JEFFERSON	WPSE	22	44.5 N	153.1 E	12	22	M 50	10 NM	02	0987.8	0.6	- 0.6	3	6.5	22	7	11.5
OLIVE ACE	3EOR	24	49.2 N	154.0 W	18	17	M 50	.25 NM	80	0995.0	6.0	9.0	3	8	15	6	13
EVER LIVING	RKMG	25	36.6 N	174.1 E	23	29	M 38			1004.0	10.0	14.0	10	24.5	24	10	32.5
EVER LIVING	RKMG	26	35.9 N	172.7 E	05	26	M 29	10 NM	01	1011.0	10.5	15.0	6	24.5	25	10	32.5
	KRJG	26	36.9 N	167.3 E	06	28	M 23	10 NM	15	1013.4	11.5		5	10	27	13	28
PRESIDENT JOHNSON	WVHS	26	49.8 N	168.2 W	12	21	50	5 NM	51	0979.0	5.6	3.9	4	19.5	18	10	32.5
LEXA MAERSK	OXFB	26	53.8 N	160.9 W	22	21	55	1 NM	25	0980.0	3.2		8	29.5			
USCGC MIDGETT (WHEC 726)	NMWR	27	54.6 N	158.7 W	00	20	M 38	1 NM	58	0978.5	5.0	2.2	12	32.5			
LEXA MAERSK	OXFB	27	53.7 N	161.1 W	00	23	55	1 NM	60	0981.5	3.5	3.0	9	29.5			
EXXON PHILADELPHIA	WNFJ	27	41.1 N	125.8 W	18	36	M 26	10 NM	02	1020.8		9.4	3	10	02	8	24.5
	PACIFIC	MAR.															
ARCTIC TOKYO	SLJT	6	53.1 N	172.2 E	06	27	M 55	5 NM	86	1016.0	- 0.5	3.0	12	26			
EASTERN VENTURE	JDWT	7	47.8 N	160.6 E	00	30	67	.25 NM	96	0996.0	- 1.0	1.5	25	44	30	25	44
GOLDEN COAST	3FFR	12	53.5 N	169.8 W	06	25	M 57	1 NM	23	0992.5	- 1.2	4.0	12	28	26	12	28
SNAUGRAN	LNUR	12	53.6 N	177.1 W	12	26	M 57	1 NM	84	0996.0	- 1.0	3.0	7	16.5	26	13	24
PRESIDENT CLEVELAND	KGXA	22	56.8 N	151.2 W	06	06	50	5 NM		0988.0	3.9	4.4	6	26	09	10	29.5
PRESIDENT TYLER	WE7M	23	53.9 N	159.3 W	06	32	M 52	2 NM	60	1002.0	1.1	3.3	6	14.5	32	10	29.5

+ Direction of sea waves same as wind
X Direction or period of waves indeterminate
M Measured wind

NOTE: The observations are selected from those with winds ≥ 40 kn or waves ≥ 20 ft from April through September and 45 kn or 30 ft October through March.

U.S. Voluntary Observing Ship Weather Reports

January, February and March 1985

SHIP NAME	VIA RADIO	VIA MAIL
ACADIA	32	71
ADABELLE LYKES	58	110
ADDIRIYAH	29	
ADONIS	65	22
AFRICAN ADDAX	20	46
AL AHMADIAH	66	35
ALASKA STANDARD	70	105
ALASKAN	17	
ALBULA	10	79
ALDEN W. CLAUSEN		255
ALEUTTAN DEVELOPER	35	77
ALMERIA LYKES	64	149
ALPINE ROSE	5	25
ALVA MAERSK	19	47
AM. ALABAMA		23
AMELIA TOPIC	52	129
AMERICAN ALTAIR	14	
AMERICAN APOLLO	47	89
AMERICAN AQUARIUS	70	127
AMERICAN ARGO	46	104
AMERICAN ASTRONAUT	73	80
AMERICAN ORACC	39	117
AMERICAN EAGLE	36	27
AMERICAN ENVOY	84	156
AMERICAN HERITAGE	25	78
AMERICAN LANCER	13	64
AMERICAN LARK	76	113
AMERICAN LEGION	55	145
AMERICAN LIBERTY	54	195
AMERICAN LYNX	98	152
AMERICAN MARKETER	63	158
AMERICAN MERCHANT	68	107
AMERICAN NEW JERSEY	18	46
AMERICAN NEW YORK	12	114
AMERICAN PIONEER	57	79
AMERICAN PURITAN	51	147
AMERICAN RESERVIST	100	112
AMERICAN RESOLUTE	71	8
AMERICAN RIGEL	75	105
AMERICAN SKY	58	103
AMERICAN TITAN AK 1008	48	95
AMERICAN TRADER	75	155
AMERICAN TROJAN	10	5
AMERICAN VEGA	57	164
AMERICAN VETERAN	1	
AMERICANA	34	54
AMOCO BALTIMORE	45	55
AMOCO CAIRO	26	
AMOCO VOYAGER	1	
AMOCO YORKTOWN	56	12
ANJA LEONHARDT	35	58
ANNIE JOHNSON		49
AOM WM. H. CALLAGHAN	35	138
AQUA CITY	114	96
AQUARIUS	86	201
ARCHON	31	12
ARCO ALASKA	68	57
ARCO ANCHORAGE	9	
ARCO CALIFORNIA	23	31
ARCO FAIRBANKS	63	70
ARCO JUNEAU	33	25
ARCO PRUDHOE BAY	51	64
ARCO SAG RIVER	17	22
ARCO TEXAS	19	18
ARCTIC TOKYO	1	195
ARGONAUT	44	122
ARIES	1	
ARILD MAERSK	4	
ARMAND HAMMER	8	64
ASHLEY LYKES	26	33
ASIA HERON	89	154
ASIA INDUSTRY	44	
ATIGUN PAS	1	22
ATIGUN PASS	57	30
ATLANTIC RAINBOW	6	
AUSTANGER	15	26
AXEL JOHNSON	14	36
B.T. ALASKA	65	52
B.T. SAN DIEGO	82	106
BAILEY	7	16
BALLARD		34
BALTIMORE TRADER	44	155
BANGLAR MANOLI	6	40
BARI ZAN	31	62
BARBER PRIAM	73	100
BARBER TAIF	18	37
BARBER TAMPA	9	58
BARBER TEXAS	29	30
BARBER TUNA	31	62
BARBER TONSBERG	20	37
BAY BRIDGE	67	152
BAYAMON	48	15
BEAUJOLAIS	7	
BELO ORIENTE	28	
BELO RIO	64	101
BERMINA	32	118
BIEHL TRADER		14
BLUE COSMO	66	97
BOGASARI DUA	38	62
BOGASARI LIMA	8	22
BOHEME	71	22
BORINCUEN	71	123
BOSTON	1	
BRIGHT SUN	127	194
BRINTON LYKES	1	
BROOKS RANGE	15	44
BUNGA KESIDANG	76	100
BUNGA MELAWIS	23	41
C.W. MITTO		60
CANADIAN HIGHWAY	29	39
CANAL ACE		20
CHARLES LYKES	77	153
CHARLES PIGOTT		54
CHARLOTTE LYKES	105	214
CHARLOTTE MAERSK	88	156
CHASTINE MAERSK	7	51
CHELSEA	16	87
CHEMICAL PIONEER	22	102
CHERRY VALLEY	8	
CHESAPEAKE	76	88
CHESNUT HILL	106	228
CHEVRON ANTWERP	20	97
CHEVRON ARIZONA	43	39
CHEVRON CALIFORNIA	184	167
CHEVRON COLORADO	21	20
CHEVRON COPENHAGEN	26	
CHEVRON EFLUV	55	12
CHEVRON FRANKFURT	4	
CHEVRON LONDON		124
CHEVRON LOUISIANA	11	16
CHEVRON MISSISSIPPI	115	128
CHEVRON NORTH AMERICA	23	103
CHEVRON OREGON	75	81
CHEVRON PERTH	33	162
CHEVRON WASHINGTON	91	111
CHEYENNE	1	
CHRISTIAN MAERSK	9	29
CITY OF MIDLAND	36	132
CLARA MAERSK	49	109
CLIFFORD MAERSK	26	51
CLOVER TRUST	15	
CO-OP GRAIN II	50	35
COLUMBUS AMERICA	149	
COLUMBUS LOUISANA	48	
CONTINENTAL HIGHWAY	87	31
CONTINENTAL TRADER	21	
COOP EXPRESS II		6
CORNUCOPIA	66	166
COSMIC JUPITER	31	137
COVADONGA	15	
CRYSTAL STAR	41	63
CYGNUS	71	
D.L. ROWE		53
DA MOSTO	5	13
DACEBANK	78	
DAGLAND	132	168
DAVID D. TINKIN	1	9
DAWN	125	161
DELAWARE TRADER	66	126
DELTA SUD	9	
DIANA		36
DOCTOR LYKES	50	160
DOLLY TURMAN	40	53
DRAGOR MAERSK	28	77
DUBHE	51	68
DYUI SPAGERAK	13	114
EASTERN BRICE	47	68
EASTERN DIAMOND	19	20
EASTERN FRIENDSHIP	49	126
EASTERN GLORY	11	160
EASTERN GRACE		116
EASTERN ROYAL	92	66
EASTERN SAGA	39	97
EASTERN VENTURE	18	27
EATON GLORIA	86	
EDGAR M. QUEENY	7	
EDITA	15	
ELIZABETH LYKES	26	107
ENDEAVOR		42
ESSO PALM BEACH	23	65
EVER GENTLE		32
EVER GENTRY	18	7
EVER GIFTED	61	28
EVER GLORY		77
EVER GRACE		31
EVER GREET		20
EVER LAUREL	52	206
EVER LEVEL	92	70
EVER LINKING		124
EVER LIVING	1	130
EVER LOADING		19
EVER LYRIC	36	34
EVER SHINE	10	52
EVER SPRING	22	
EVER SUMMIT	16	73
EVER SUPERB	98	174
EVER VALIANT	53	112
EVER VALUE	25	23
EVER VIGOR	1	174
EVER VITAL	46	134
EXPORT CHALLENGER	27	79
EXPORT CHAMPION	47	115
EXPORT COURIER		14
EXPORT FREEDOM	45	125
EXPORT PATRIOT	26	92
EXXON BATON ROUGE	58	48
EXXON BAYTOWN	14	21
EXXON BENICIA	15	24
EXXON BOSTON	122	150
EXXON GETTYSBURG	3	11
EXXON HOUSTON	62	65
EXXON JAMESTOWN	39	45
EXXON LEXINGTON	60	85
EXXON NEW ORLEANS	17	
EXXON NORTH SLOPE	4	5
EXXON PHILADELPHIA	70	54
EXXON PRINCETON	20	28
EXXON SAN FRANCISCO	15	19
EXXON WASHINGTON	28	29
EXXON YORKTOWN	19	17
F P CONVEYOR		11
FAIR SEA	48	71
FALCON LEADER	39	70
FALSTRIA	109	95
FEDERAL BULKER	1	
FEDERAL FRASER	28	58
FERNCROF	115	178
FETISH	10	8
FIGARO	14	38
FJORD STAR	37	74
FORTALEZA	51	74
FRANCIS SINCERE NO 6	37	27
FRASER	3	
FREDERICK LYKES	77	160
FRIENDSHIP	66	
FROTASIRIUS	14	16
G/T CHEVRON COLORADO		7
GALVESTON	60	60
GAMA GETAH	2	58
GAMA ROBUSTA	6	
GAS LIBRA	1	
GEMINI		22
GENERAL M. BELGRANO	4	18
GENEVIEVE LYKES	1	36
GEORGE H. WEYERHAEUSER		121
GEORGE WYTHE	6	53
GERONTHO		41
GLACIER BAY	18	
GLOBAL FRONTIER	32	102
GLOBAL PIONEER	33	48
GLORAL SPLENDOUR	4	14
GLORIOUS SPICA	6	29
GOLD LUCKY		12
GOLDEN APO	24	7
GOLDEN BEAR	43	
GOLDEN COAST	6	14
GOLDEN GATE	34	57
GOLDEN GRAMPUS	17	67
GOLDEN HAWK	50	123
GOLDEN ORCHID	19	14
GOLDEN PHOENIX	30	
GOWA	6	
GREAT LAND	50	74
GREAT OCEAN	113	7

SHIP NAME	VIA RADIO	VIA MAIL
GREEN FOREST	44	13
GREEN MAYA	51	
GREEN STAR	67	75
GREEN WOOD		41
GUADALUPE I		40
H. LEE SELVY	47	
H.J. HAYNES		64
HANJIN CHEJU		14
HANJIN INCHEON	31	35
HANJIN KWANGYANG		38
HANJIN POHANG	39	40
HARBOUR BRIDGE	120	87
HARDANGER	2	
HAUL TRACER		109
HOEGH CAIRN	13	10
HOEGH CLIPPER	2	18
HOEGH DENE	9	19
HOEGH DRAKE	9	60
HOEGH DYKE	3	
HOEGH MALLARD	3	
HOEGH MARLIN	39	57
HOEGH MASCOT	11	101
HOEGH MIRANDA	31	110
HOEGH SUN	29	92
HONSING ARROW	35	148
HONSING BREEZE	101	157
HONSHU GLORIA	29	104
HOWELL LYKES	9	18
HOYO MARU	43	29
HUAL TRAVELLER	2	
HYUNDAI # 14	23	
HYUNDAI # 23	8	20
HYUNDAI #3	32	44
HYUNDAI ATLANTIC	9	
HYUNDAI CON # 22	34	
HYUNDAI NO.6	1	20
IIONA	8	15
INGER	6	28
IRIS ISLAND	72	
ITALICA	35	57
J. LOUIS	5	51
J.T. HIGGINS		49
JADE PHOENIX	8	
JADRAN	3	
JALAMOKAMBI	6	
JALAVIJAYA	46	
JALISCO	5	18
JAMES LYKES	6	18
JAPAN AMBROSE	38	27
JAPAN APOLLO	80	132
JAPAN RAINBOW	8	17
JAYAKARTA	10	
JEAN LYKES	15	26
JOHN A. MCCONE		76
JOHN LYKES	52	75
JOSEPH LYKES	27	96
JUNO	14	
JUPITER NO 1	19	22
KAUAI	83	164
KEIYO	14	
KENAI	107	241
KENNETH E. HILL		160
KENNETH T. DEPR		66
KENWOOD	10	39
KEYSTONER	39	138
KOFUKU MARU	46	
KOREAN AMETHYST	9	
KOREAN FIR	9	19
KOREAN JACEWON	59	68
KOREAN PRIDE	34	19
KOREAN WONIS JIN	10	66
KOREAN WONIS ONE	51	42
KOREAN WONIS SEVEN	22	18
KOREAN WONIS SUN	20	18
L.W. FUNKHOUSER	7	
LA MOLINERA	3	
LAKE SUWA	91	154
LAKES STAR	1	
LARS MAERSK	36	85
LASH ATLANTICO	12	76
LASH ITALIA	33	100
LASH PACIFICO	31	94
LAURA MAERSK	33	84
LAUST MAERSK	34	89
LAVAUX	5	
LEADBON		14
LEDA MAERSK	25	29
LEISE MAERSK	19	65
LESLIE LYKES	19	
LEXA MAERSK	61	104
LICA MAERSK	20	79
LILLOOET	25	44
LLOYD ALTAMIRAP		6
LNG LEO	96	176
LNG TAURUS	1	92
LONG LINES	3	8
LOUIS J. HANGE JR.		3
LOUIS MAERSK	58	67
LOUISE LYKES	52	100
LUCENT STAR	130	
LUNA MAERSK	65	71
LURLINE	126	212
M P GRACE	2	
M.S. PACIFIC VICTORY		14
M.S. SELVA		19
M.V. BUNGA SRIPAGI	39	67
M.V. CHESAPEAKE TRADER	62	196
M.V. EVER GLOBE		6
M.V. KALIDAS	6	21
M.V. NEPTUNE TOURMALIN		20
M.V. OREGON RAINBOW II		166
M.V. ORIENTAL PATRIOT		2
M.V. PRESIDENT EISENHO	86	163
M.V. SANGKULIRANG VII	51	63
M.V. UNITED SPIRIT		16
M/S TRIGGER		94
M/T ECLIPSE	64	102
M/V DANDY I		3
M/V NATIONAL PRIDE		23
M/V SOUTHERN ACCORD		35
M/V SPRING PIRDF		274
M/V STAR THAILAND	2	22
MAERSK WAVE		148
MAERSK WIND		87
MALACCA	25	
MALLORY LYKES	26	
MAMMOTH PINE	75	49
MANHATTAN DUKE	16	
MANILA PACIFIC	30	
MANUKAI	115	208
MANULANI	69	183
MARATHA SHOGUN	64	70
MARCONA CONVEYOR	77	41
MARDI GRAS	1	1
MARGARET LYKES	98	190
MARIA TOPIC	2	
MARITIME NOBLE	68	63
MARJORIE LYKES		6
MARLIN	1	
MASON LYKES	24	73
MATARAM	5	
MATHILDE MAERSK	36	67
MAUI	92	167
MAURICIO DE OLIVEIRA	18	65
MAYA		129
MELBOURNE HIGHWAY		15
MELVILLE	87	98
MEONIA	90	161
MERAK EIGHTY	19	13
MICRONESIAN COMMERCE		200
MICRONESIAN INDEPENDEN	21	24
MING AUTUMN	1	
MING GALAXY	4	72
MING GLORY	30	38
MING MOON	1	41
MING OCEAN	18	20
MING STAR	7	
MING SUN	2	14
MING UNIVERSE	13	64
MISSION SANTA CLARA	14	92
MIXTECO	48	155
MOANA PACIFIC	86	156
MOBIL ARCTIC	91	256
MOBIL MERIDIAN	79	153
MOKU PAHU	104	140
MORMACSTAR	5	
MORMACSUN	63	71
MOSMAN STAR		39
MV AMERICAN MAINE	46	82
MV DAMA PALA		63
MV LOUIS J HANGE JR.	13	23
MV MANILA TRIUMPH	17	40
MV ORIENTAL EDUCATOR	55	140
MV ORIENTAL PATRIOT	18	18
MV PACEP		71
MV SAPPHIRE GLORY	1	23
NACIONAL MONCHIQUE	32	
NACIONAL SANTOS	11	4
NANCY LYKES	5	
NATIONAL DIGNITY	47	99
NATIONAL HONOR	12	77
NATIONAL PRIDE	7	
NAVIOS ENTERPRISE	2	
NEPTUNE DIAMOND	82	107
NEPTUNE PEARL	48	86
NEW INDEPENDENCE	77	209
NEWARK	41	35
NICOLA PROSPERITY	11	
NISSAN MARU	13	29
NOAA DAVID STARR JORDA	19	13
NOAA SHIP ALBATROSS IV	36	128
NOAA SHIP CHAPMAN	60	91
NOAA SHIP DAVIDSON	29	27
NOAA SHIP DELAWARE II	46	134
NOAA SHIP DISCOVERER C	115	45
NOAA SHIP FERREL	8	2
NOAA SHIP MCARTHUR	14	50
NOAA SHIP MILLER FREEM	190	154
NOAA SHIP MT MITCHEL	68	187
NOAA SHIP PIERCE	7	
NOAA SHIP RESEARCHER	1	
NOAA SHIP SURVEYOR	45	44
NOAA SHIP WHITING	3	160
NORWAY	32	
OAK SUN		56
OAKLAND	29	
OREPON	41	87
OCEAN HOPE	1	
OCEAN STEELHEAD	42	
OCTA	48	180
OGDEN DYNACHEM	22	46
OLEANDER	165	181
OLGA TOPIC	30	141
OLIVE ACE		17
ORCO MINER	16	
ORCO TRADER	104	233
ORIENTAL EXECUTIVE	46	140
ORIENTAL EXPLORER		160
ORIENTAL GOVERNOR		53
ORIENTAL KNIGHT	15	5
ORIENTAL MINISTER		102
ORIENTAL SOVEREIGN	13	5
ORIENTAL TAIO	18	
OVERSEAS ARCTIC	35	176
OVERSEAS BOSTON	14	220
OVERSEAS CHICAGO	4	63
OVERSEAS JUNEAU	46	
OVERSEAS MARILYN	4	
OVERSEAS NATALIE	71	97
OVERSEAS NEW YORK	20	79
OVERSEAS VIVIAN		34
OVERSEAS WASHINGTON	35	75
PACBARON	34	
PACBARONESS	11	
PACDUCHESS	24	
PACDUKE	24	
PACEMPEROR	32	44
PACGLORY	29	
PACIFIC ANGEL		65
PACIFIC ARROW	215	90
PACIFIC BRIDGE	21	21
PACIFIC EPA	8	
PACIFIC EXPRESS	10	5
PACIFIC SAGA	39	
PACIFIC SUNSHINE		11
PACIFIC VENTURE	73	51
PACIFIC VICTORY	36	23
PACIFIC WIND	65	
PACKING		41
PACLADY	42	5
PACMAJESTY	8	1
PACMERCHANT	36	18
PACMONARCH	23	24
PACNOBLE	17	
PAN DYNASTY	3	
PAN STAR		24
PANAMA	46	119
PARALLA	49	93
PAUL PIGOTT	1	
PENNSYLANIA RAINBOW	29	23
PENNSYLVANIA SUN	17	39
PENNSYLVANIA TRADER	8	6
PHILADELPHIA	42	102
PHILADELPHIA SUN	22	55
PHOENIX	51	156
PITTSBURGH	77	153
PLANTIN	131	196
POLAR ALASKA	15	176
POLYNESIA	104	208
PONCE	14	23
PORTLAND	15	27
POTOMAC TRADER	26	171
PRES. F. D. ROOSEVELT	70	186
PRESIDENT CLEVELAND	15	65
PRESIDENT GRANT	117	190
PRESIDENT HOOVER	61	113
PRESIDENT JACKSON	20	34
PRESIDENT JEFFERSON	48	142
PRESIDENT JOHNSON	58	150
PRESIDENT KENNEDY	43	11
PRESIDENT LINCOLN	66	115
PRESIDENT MADISON	73	92

SHIP NAME	VIA RADIO	VIA MAIL
PRESIDENT MC KINLEY	99	107
PRESIDENT MCKINLEY		80
PRESIDENT MONROE	48	157
PRESIDENT PIERCE	19	44
PRESIDENT ROXAS	5	
PRESIDENT TAYLOR	6	17
PRESIDENT TYLER	89	179
PRESIDENT WASHINGTON	93	160
PRESIDENT WILSON	35	
PRINCE OF TOKYO	63	169
PRINCE WILLIAM SOUND	5	14
PROSPERIDAD	54	
PUNTA BRAVA	5	
QUATSINO SOUND		139
QUEEN OPAL	31	
RAINBOW HOPE	12	256
RAPID	59	155
RED ARROW	37	
REGENT CEDAR	42	30
REGINA MAERSK	54	140
RICHARD		81
RIGOLETTO	67	105
RIO GRANDE	8	24
ROACHBANK	105	
ROBERT D. CONRAD	9	68
ROBERT E. LEE	12	
RODRIGUES CABRILHO	35	44
ROSE	3	170
ROSINA TOPIC		131
ROVER		195
ROYAL SAPPHIRE	1	19
ROYAL VIKING STAR	27	
RUTH LYKES	47	116
S.T. CRAPO	2	
SACRAMENTO	49	153
SAINT LOUIS	45	172
SAM HOUSTON	12	
SAMUEL H. ARMACOST		18
SAMUEL S	46	34
SAN JUAN	114	184
SANKO ANTARES		14
SANKO AZALEA		68
SANKO CYCLAMAN		65
SANKO DENEB		30
SANKO HEUANTHUS		17
SANKO PINNACLE		30
SANKO ROBIN		46
SANKO STAR		79
SANKO STORK		36
SANSINENA II	79	75
SANTA ADELA	40	114
SANTA CRUZ II	38	48
SANTA FE		1
SANTA JUANA	141	218
SANTA MAGDALENA	1	
SANTA MARIA	1	
SATURN DIAMOND	2	98
SAUDI MAKKAH	67	
SAUDI RIYADH	23	
SAVONITA	50	79
SEA BELLS		26
SEA DIAMOND		136
SEA FAN		108
SEA FORTUNE		58
SEA JADE	61	15
SEA LANTERN	7	23
SEA LIGHT		112
SEA QUEEN NO 1	75	99
SEALAND ADVENTURER	85	175
SEALAND CONSUMER	43	139
SEALAND DEFENDER	105	190
SEALAND DEVELOPER	101	151
SEALAND ECONOMY	47	180
SEALAND ENDURANCE	64	165
SEALAND EXPLORER	64	125
SEALAND EXPRESS	107	172
SEALAND FREEDOM	52	30
SEALAND INDEPENDENCE	106	177
SEALAND INNOVATOR	96	108
SEALAND LEADER	66	196
SEALAND LIBERATOR	62	93
SEALAND MARINER	58	165
SEALAND PACER	10	14
SEALAND PATRIOT	72	157
SEALAND PIONEER	51	127
SEALAND PRODUCER	31	134
SEALAND VENTURE	65	191
SEALAND VOYAGER	86	165
SENATOR	1	
SEVEN OCEAN	36	4
SHELDON LYKES	148	165
SHIRLEY LYKES	19	61
SIDNEY FOSS		24
SIOUX T-ATF	9	9
SKAUGRAN	69	166
SKOUBORG	64	128
SOHIO RESOLUTE	103	162
SOLON TURMAN	19	42
SOUTH LIGHT	17	
SPRING BALLAD	9	
SPRING BIRD	19	62
SPRING BLOSSOM	1	
SPRING BREEZE		351
SS BORINQUEN		55
SS NEVARK		96
ST CERCUE		13
STAR CARRIER	33	32
STAR DIEPPE	16	
STAR DOVER	33	42
STAR EAGLE	101	122
STAR ENTERPRISE	9	
STAR HONG KONG	41	15
STAR KANDA	42	43
STAR LUZON	8	
STAR MALAYSIA	11	27
STAR PHILLIPPINES	35	64
STAR SINGAPORE	19	69
STARWARD	50	
STATE OF MAINE	25	
STEADFAST	26	10
STELLA LYKES	23	14
STOLT LLANDAFF		3
STONEWALL JACKSON	23	32
STREAM HAWSER	6	
SUGAR ISLANDER	4	
SUN VIKING	25	26
SUNBELT DIXIE	200	120
SYLVO	8	
SYOSSET	4	
TAI CORN	57	
TARASCO	47	90
TENCHBANK	60	
TEXACO GEORGIA	2	19
TEXAS SUN	6	29
TEXAS TRADER	106	252
TEXICO CALIFORNIA		29
TFL DEMOCRACY	39	157
TFL ENTERPRISE	52	65
TFL EXPRESS	70	164
TFL FRANKLIN	72	
TFL FREEDOM	39	136
TFL INDEPENDENCE	77	169
TFL JEFFERSON	22	
TFL LIBERTY	53	148
THAMES	11	44
THOMAS G. THOMPSON	10	17
THOMAS WASHINGTON	106	131
THOMPSON LYKES	22	87
THOMPSON PASS	25	
TILLIE LYKES	53	139
TOKYO RAINBOW	82	58
TONCI TOPIC	20	
TONSONIA	22	199
TOWER BRIDGE	105	37
TOWNSEND CROMWELL	60	129
TOYOTA #24	146	64
TRANSCOLORADO	5	
TRANSCOLUMBIA	42	44
TRITON	21	107
TROPIC SUN	9	27
TYSON LYKES	86	166
ULTRAMAR	10	
ULTRASEA	28	107
UNICORN	1	57
UNIVERSE	13	
USCGC ACACIA (WLB406)	2	
USCGC ALERT (WMEC 630)	46	
USCGC BASSWOOD (WLB 39	17	17
USCGC BOUTWELL WHEC 71	50	65
USCGC CHASE (WHEC 718)	2	
USCGC CHEROKEE WHEC 16	4	5
USCGC CHILULA (WHEC 15		109
USCGC CITRUS (WMEC 300	9	
USCGC CLOVER (WMEC 292	9	
USCGC CONFIDENCE		42
USCGC COURAGEOUS	16	
USCGC DAUNTLESS WMEC 6	60	26
USCGC DEPENDABLE	16	6
USCGC DILIGENCE WMEC 6	15	
USCGC DUANE (WMEC 33)	121	105
USCGC DURABLE (WMEC 62	12	60
USCGC FIREBUSH WLB 397	21	
USCGC GLACIER (WAGB 4)	192	193
USCGC HAMILTON WHEC 71	15	17
USCGC INGHAM (WHEC 35)	8	
USCGC IRONWOOD (WLB 29	4	
USCGC LAUREL (WLB 291)	25	78
USCGC MALLOW (WLB 396)	25	
USCGC MESQUITE (WLB 30	32	
USCGC MIDGETT (WHEC 72	2	120
USCGC MUNRO (WHEC 724)		4
USCGC NORTHWIND WAGB 2	6	6
USCGC POINT ROBERTS	1	
USCGC POLAR SEA WAGB 1	33	
USCGC POLAR STAR WAGB	177	183
USCGC RESOLUTE WHEC 62	6	
USCGC SEDGE (WLB 402)	13	
USCGC SHERMAN (WHEC 72	13	
USCGC STORIS (WMEC 38)	3	
USCGC SWEETBRIER WLB 4	34	
USCGC TAMAROA (WMEC 16	3	6
USCGC VALIANT (WMEC 62	1	
USCGC VENTUROUS WMEC 6		36
USCGC VIGOROUS WMEC 62	29	
USCGC WOODRUSH (WLB 40	15	
USCGC YOCONA (WMEC 168	52	
USNS ANTARES	12	
USNS APACHE	71	67
USNS BARTLETT	87	108
USNS CHAUVENET	6	37
USNS DE STEIGUER	87	170
USNS HARKNESS TAGS 32	64	
USNS KANE TAGS 27		80
USNS LYNCH T-AGOR 7	160	238
USNS MAUMEE	70	168
USNS METEOR T-AKR 9	19	44
USNS MISPILLION		25
USNS MISSISSINEWA		246
USNS MOHAWK	26	
USNS PASSUMPSIC TAO 10		25
USNS PAWCATUCK TAO-108		1
USNS PONCHATOULA	44	15
USNS POWHATAN TATF 166	23	
USNS RANGE SENTINEL	1	
USNS REDSTONE	2	86
USNS RIGEL TAF 58		97
USNS SATURN T-AFSIC		45
USNS SEALIFT ANTARCTIC	8	
USNS SEALIFT ARCTIC	62	114
USNS SEALIFT CARIBBEAN	21	
USNS SEALIFT CHINA SEA	34	
USNS SEALIFT INDIAN OCE		1
USNS SEALIFT MED	65	80
USNS SOUTHERN CROSS	2	
USNS TRUCKEE TAO-147		99
USNS VANGUARD TAG 194	34	60
USNS WACCAMAW(TAO-109)		217
VALLEY FORGE	31	52
VAN ENTERPRISE	23	58
VAN FORT	8	29
VAN HAWK	114	161
VELMA LYKES	19	
VENTURE STAR		66
VISHVA PRAFULLA	26	
WALCHAND	36	
WALTER PICE	31	80
WASHINGTON PAINROW #2		10
WASHINGTON TRADER	92	188
WECOMA	14	202
WESTERN SUN	11	53
WESTIN WON	6	1
WESTWARD VENTURE	37	9
WILLIAM E. HUESMAN		229
WILLIAM HOOPER	24	
YAHASHIN MARU	165	45
YASHIMA MARU	55	32
ZEPHUNTER	126	157
ZEUS	14	61
ZOELLA LYKES	28	22

SUMMARY: GRAND TOTAL VIA RADIO 27495 GRAND TOTAL VIA MAIL 51744 TOTAL UNIQUE ORS 66529

JANUARY 1985

BUOY	LAT	LONG	AIR TEMPERATURE (DEG C) OBS	DAYS	MAX	DY	HR	MIN	DY	HR	MEAN	SEA TEMPERATURE (DEG C) OBS	DAYS	MAX	DY	HR	MIN	DY	HR	MEAN	AIR-SEA TEMPERATURE DIFFERENCE (DEG C) OBS	DAYS	MAX	DY	HR	MIN	DY	HR	MEAN
32301	-0. N	105.0W	323	14	24.5	12	19	20.9	07	14	23.4	323	14	24.3	13	20	23.7	01	06	23.9	323	14	00.5	04	16	-02.8	07	14	-00.5
41001	34.9N	072.9W	590	26	21.2	05	01	00.4	21	18	12.6	605	26	21.4	03	15	18.6	22	06	20.0	605	26	00.0	05	01	-19.5	21	05	-07.6
41002	32.3N	075.3W	742	31	24.5	04	17	02.6	21	12	15.7	741	31	25.5	02	21	18.8	27	05	21.0	742	31	00.9	31	22	-17.6	21	12	-05.3
41006	29.3N	077.3W	743	31	24.3	04	14	09.6	21	22	18.5	743	31	24.7	01	04	20.8	27	06	22.8	743	31	00.8	29	01	-12.6	21	22	-04.4
42001	25.9N	089.7W	740	31	24.5	01	19	10.3	21	23	20.0	740	31	24.4	01	20	21.6	22	10	22.5	740	31	01.6	31	16	-11.5	21	23	-02.6
42002	26.0N	093.5W	706	30	23.8	01	01	09.2	21	12	18.7	705	30	24.1	01	19	20.8	25	05	22.5	706	30	01.0	24	13	-12.7	21	12	-03.8
42003	26.0N	085.9W	743	31	26.5	31	11	14.2	21	16	22.1	743	31	25.8	11	21	21.5	06	07	24.4	743	31	02.1	01	08	-10.1	21	16	-02.3
42007	30.1N	088.9W	704	30	21.8	01	03	00.0	22	04	09.7	742	31	19.5	01	01	08.6	26	05	13.2	742	31	05.9	31	13	-14.3	04	06	-04.0
44004	38.5N	070.7W	670	30	19.4	05	08	00.0	09	14	06.9	724	31	19.7	31	23	12.1	30	01	14.9	730	31	03.4	05	08	-15.8	09	11	-08.5
44005	42.7N	068.4W	306	23	10.0	02	07	00.0	19	13	02.5	739	31	08.1	01	14	06.1	29	12	07.1	739	31	02.0	02	07	-07.8	05	19	-05.9
44007	43.5N	070.1W	353	11	05.3	01	02	00.0	24	00	01.2	719	31	08.0	02	15	03.9	29	13	06.4	724	31	-02.0	01	02	-07.6	02	15	-05.7
44008	40.5N	069.4W	435	27	14.4	02	05	00.0	11	02	04.2	740	31	10.5	01	10	02.4	30	17	06.9	744	31	04.2	02	05	-08.8	08	21	-04.3
44011	41.1N	066.6W	400	22	14.3	05	12	00.0	09	06	04.7	524	22	09.1	04	15	05.7	19	11	07.1	525	22	06.4	05	12	-08.1	09	07	-03.4
44012	38.8N	074.6W	439	27	13.2	02	01	00.0	09	03	03.8	728	31	09.8	01	09	02.0	28	05	05.8	734	31	03.8	02	01	-08.2	09	03	-03.3
44013	42.4N	070.8W	150	20	06.7	02	00	00.0	06	17	01.9	740	31	06.7	01	01	02.4	28	12	04.7	744	31	00.1	02	00	-06.5	03	06	-03.9
46001	56.3N	148.3W	742	31	07.0	10	08	03.3	24	10	05.4	742	31	06.2	01	01	05.6	22	15	05.8	742	31	01.2	10	08	-02.6	04	06	-00.4
46002	42.5N	130.3W	169	08	10.1	25	03	07.2	26	12	08.7	169	08	10.9	25	00	10.1	31	06	10.6	169	08	-00.8	25	03	-03.6	26	12	-01.9
46003	51.9N	155.7W	740	31	06.8	29	06	02.4	04	02	04.7	740	31	05.3	01	01	04.6	21	15	04.9	740	31	02.1	29	05	-02.8	04	02	-00.1
46005	46.1N	131.0W	744	31	10.8	11	13	06.1	30	17	08.8	744	31	09.9	20	23	09.3	12	06	09.5	744	31	01.4	11	13	-03.3	30	17	-00.7
46006	40.7N	137.7W	741	31	14.5	10	17	07.9	26	21	11.8	741	31	13.7	29	20	12.5	09	14	13.1	741	31	01.9	10	17	-05.4	26	21	-01.3
46010	46.2N	124.2W	144	06	06.5	29	03	02.7	28	04	04.4	144	06	08.4	27	00	04.1	28	16	06.6	144	06	00.7	29	06	-04.9	28	04	-02.2
46011	34.9N	120.9W	743	31	16.0	04	22	08.7	18	15	12.1	743	31	14.4	05	00	12.6	01	10	13.5	743	31	01.7	03	03	-04.8	18	15	-01.3
46012	37.4N	122.7W	738	31	15.6	03	21	08.5	20	16	11.7	738	31	12.9	08	23	11.7	23	11	12.2	739	31	03.4	03	21	-03.4	20	16	-00.5
46013	38.2N	123.3W	734	31	13.2	04	00	06.0	15	17	09.8	734	31	12.4	28	00	11.2	01	18	11.7	737	31	01.7	04	00	-05.9	23	15	-01.9
46014	39.2N	124.0W	737	31	13.9	04	22	06.4	28	15	10.2	737	31	12.8	26	21	11.1	31	14	11.7	738	31	02.4	06	16	-05.1	28	15	-01.5
46016	63.3N	170.3W	014	04	01.3	01	15	00.1	01	21	00.6																		
46017	60.3N	172.3W	136	23	04.0	28	03	00.1	02	03	01.3																		
46018	60.3N	177.0W	115	24	03.1	28	03	00.0	02	03	01.2																		
46022	40.8N	124.5W	740	31	14.1	06	22	06.6	02	10	10.0	740	31	11.7	23	23	09.9	01	13	10.8	740	31	03.0	07	04	-04.0	29	16	-00.9
46023	34.3N	120.7W	628	27	15.8	25	22	09.6	28	21	12.5	628	27	15.1	25	23	13.2	13	07	13.6	628	27	02.0	15	00	-04.0	28	21	-01.1
46024	32.8N	119.5W	741	31	16.0	24	00	11.4	28	17	13.4	741	31	15.3	07	03	13.3	31	16	14.4	741	31	01.2	02	17	-03.2	10	13	-00.9
46025	33.6N	119.0W	743	31	18.0	04	23	10.5	10	17	13.6	743	31	15.8	25	22	14.1	13	10	14.4	743	31	03.5	04	23	-03.9	28	20	-00.8
46028	35.8N	121.7W	610	31	14.7	05	08	08.7	18	04	12.0	610	31	13.5	24	00	12.2	05	17	12.7	610	31	02.1	05	08	-04.1	18	00	-00.7
46029	46.2N	124.2W	743	31	10.7	23	00	02.4	01	12	06.7	743	31	09.7	20	00	03.7	30	07	08.4	743	31	02.3	23	01	-06.1	01	12	-01.7
46030	40.4N	124.5W	742	31	14.3	06	21	06.7	02	09	10.2	742	31	11.7	24	00	09.8	01	17	10.9	742	31	03.3	06	21	-03.6	28	09	-00.8
46031	55.5N	161.7W	238	31	07.6	28	00	00.1	03	15	03.6																		
46032	54.2N	165.8W	217	31	07.3	31	18	00.7	12	18	03.5	217	31	04.7	19	06	03.4	03	15	04.6	217	31	02.7	31	18	-03.9	12	18	-01.1
46034	55.1N	163.1W	248	31	06.6	29	04	00.4	25	07	03.6	248	31	05.2	01	04	02.9	24	16	04.4	248	31	02.1	29	04	-03.7	03	19	-00.9
51001	23.4N	162.3W	739	31	24.7	01	03	16.6	30	07	22.4	740	31	24.6	04	01	23.5	15	16	24.0	740	31	00.7	14	02	-07.5	30	07	-01.7
51002	17.2N	157.8W	742	31	25.2	11	02	21.5	30	16	23.7	742	31	25.8	13	02	23.9	21	14	24.4	743	31	00.4	15	00	-03.0	30	16	-00.7
51003	19.2N	160.8W	743	31	25.4	24	23	20.4	30	22	24.0	743	31	26.1	23	00	24.5	30	22	25.2	743	31	00.0	14	19	-04.1	30	22	-01.2
51004	17.5N	152.5W	743	31	24.6	14	23	20.8	17	16	23.0	743	31	24.8	23	02	23.7	26	12	24.1	743	31	00.7	15	01	-03.2	17	16	-01.1
ALRF1	25.1N	080.7W	742	31	26.2	03	19	04.0	22	11	18.4	742	31	25.2	03	20	17.7	23	10	22.6	742	31	01.3	11	20	-15.6	22	11	-04.1
ALSN6	40.5N	073.8W	283	22	12.7	02	14	00.0	03	16	02.9	742	31	08.8	01	19	00.7	31	08	05.0	743	31	04.8	02	14	-08.3	04	11	-03.7
BURL1	28.9N	089.4W	692	30	20.8	01	04	02.0	20	16	11.0																		
CAR03	43.1N	124.4W	742	31	17.4	16	20	01.4	30	15	08.4																		
CHLV2	36.9N	075.7W	544	29	18.7	02	17	00.0	09	07	04.9	715	31	11.7	02	19	03.0	22	08	07.4	729	31	07.2	02	17	-09.4	09	07	-03.5
CLKN7	34.6N	079.8W	653	30	21.5	01	19	00.0	12	17	07.2																		
CSBF1	29.7N	085.4W	677	30	22.8	01	19	02.0	27	11	11.2																		
DBLN6	42.6N	079.5W	004	01	01.3	06	05	00.0	06	02	00.4																		
DESW1	47.7N	124.5W	740	31	10.0	05	00	01.1	01	09	06.0																		
DISW3	47.1N	090.7W	023	04	01.6	05	21	00.0	05	19	00.8																		
DSLN7	35.2N	075.3W	664	30	23.0	02	01	00.0	16	09	08.5	694	31	22.4	07	00	11.8	11	21	17.5	700	31	07.9	01	23	-19.1	26	11	-09.4
FBIS1	32.7N	079.9W	666	30	20.8	02	17	00.0	13	02	08.0																		
FFIA2	57.3N	133.6W	736	31	09.8	21	16	00.6	01	07	04.5																		
FPSN7	33.5N	077.6W	691	30	23.1	01	16	00.0	22	09	10.4	733	31	23.1	01	09	09.3	27	12	15.9	740	31	04.8	31	23	-16.7	12	16	-06.1
GDIL1	29.3N	089.9W	682	30	21.2	01	01	02.0	12	12	10.3	398	24	20.9	01	03	11.7	18	09	14.8	741	31	06.4	30	19	-10.9	04	00	-03.8
GLLN6	43.5N	076.3W	027	05	07.7	02	01	00.0	05	01	01.9																		
IOSN3	42.9N	070.6W	069	13	05.1	01	18	00.0	13	20	01.4																		
LKWF1	26.7N	080.0W	726	31	25.2	17	22	03.4	21	11	16.8	739	31	24.5	10	09	20.8	27	02	22.6	741	31	03.1	28	21	-18.1	21	13	-06.1
MDRM1	44.0N	068.1W	125	13	08.4	02	08	00.0	14	14	02.0																		
MISM1	43.8N	068.9W	115	12	08.0	02	07	00.0	01	16	01.7																		
NWPO3	44.6N	124.1W	496	22	16.4	16	22	00.0	30	10	06.7																		
PILM4	48.2N	088.4W	009	01	01.5	04	20	00.0	04	05	00.4																		
PTAC1	38.9N	123.7W	741	31	16.0	06	18	03.0	02	15	08.8																		
PTAT2	27.8N	097.1W	698	31	20.7	27	22	00.0	12	21	10.3																		
PTGC1	34.6N	120.7W	739	31	18.7	05	09	06.7	30	14	12.0																		
SSNM3	43.8N	087.7W	022	04	01.8	14	11	00.0	06	21	00.6																		
SISW1	48.3N	122.9W	721	31	08.1	05	22	00.2	11	12	04.5																		
SJLF1	30.4N	081.4W	697	30	26.8	31	20	00.0	23	12	10.8																		
SRST2	29.7N	094.1W	704	31	20.1	01	03	00.0	03	12	08.4																		
TTIW1	48.3N	124.7W	676	29	09.7	05	04	02.7	31	01	05.9																		
WPOW1	47.7N	122.4W	726	31	08.5	19	21	00.0	01	07	04.6																		

JANUARY 1985

BUOY	LAT	LONG	PRESSURE (MB) OBS	DAYS	MAX	DY	HR	MIN	DY	HR	MEAN	WIND SPEEDS (KNOTS) OBS	MAX	DY	HR	DIR	MEAN WIND SPEED (KNOTS) N	NE	E	SE	S	SW	W	NW	TOTAL
32301	-0. N	105.0W	322	14	1015.8	07	17	1009.4	02	09	1012.8	323	14	04	14	130		8.0	10.3	10.8					10.6
41001	34.9N	072.9W	603	26	1020.0	10	13	998.5	05	03	1012.4	602	41	15	09	270	15.0	6.2	8.0	15.5	19.6	24.5	27.1	25.2	23.9
41002	32.3N	075.3W	742	31	1027.5	01	14	1001.6	18	02	1015.3	742	34	26	11	300	12.6	10.0	10.2	14.5	15.0	22.0	21.2	18.6	18.4
41006	29.3N	077.3W	743	31	1026.7	01	14	1007.4	18	20	1017.8	737	31	26	11	290	9.4	7.3	13.3	10.3	14.5	17.4	19.3	16.7	16.0
42001	25.9N	089.7W	740	31	1031.2	21	16	1010.0	31	22	1020.1	739	37	03	14	310	15.4	14.9	12.4	13.0	13.8	10.3	10.8	16.7	14.0
42002	26.0N	093.5W	706	30	1033.9	21	16	1012.7	30	10	1020.4	705	33	20	20	020	17.3	16.9	14.1	14.4	13.5	8.8	6.8	14.8	14.4
42003	26.0N	085.9W	743	31	1029.0	22	16	1011.6	18	21	1019.5	743	32	04	12	320	15.8	14.6	11.3	14.9	18.1	18.8	17.3	19.0	16.2
42007	30.1N	088.9W	742	31	1036.5	21	16	1009.7	31	22	1021.3	727	27	20	13	030	13.3	12.9	8.7	8.9	9.8	9.1	10.5	11.9	11.3
44004	38.5N	070.7W	717	31	1030.2	10	14	986.8	05	08	1010.5	721	45	05	10	230	16.3	21.2	13.8	6.5	13.2	19.9	25.0	24.9	22.7
44005	42.7N	068.4W	739	31	1030.3	01	02	984.6	05	13	1005.5	738	31	16	15	310	11.6	10.2	10.9	9.9	8.2	14.8	19.1	17.2	15.9
44007	43.5N	070.1W	721	31	1030.0	03	15	988.7	22	18	1007.6	719	30	16	10	310	10.7	10.4	7.9	12.2	5.4	15.6	14.3	12.6	12.8
44008	40.5N	069.4W	740	31	1026.6	03	15	982.8	05	11	1007.7	741	20	16	13	310	7.1	6.1	4.7	5.0	6.8	7.0	12.0	10.6	09.6
44011	41.1N	066.6W	524	22	1025.4	03	15	976.5	05	15	1005.0	519	33	16	22	300	12.0	12.0	9.1	10.6	8.7	13.0	21.3	21.5	17.2
44012	38.8N	074.6W	731	31	1033.6	10	12	994.8	05	05	1013.8	732	37	15	14	320	18.2	11.0	14.4	8.0	12.4	13.2	16.3	23.0	17.1
44013	42.4N	070.8W	740	31	1030.8	03	16	992.0	05	10	1009.0	742	31	09	03	300	9.9	11.8	10.8	11.7	5.9	14.0	17.6	15.2	14.8
46001	56.3N	148.3W	742	31	1027.5	31	23	971.2	16	07	1002.5	738	34	10	17	150	20.4	19.6	17.1	16.3	13.5	15.0	13.1	9.9	15.3
46002	42.5N	130.3W	169	08	1035.3	30	20	1023.2	28	02	1028.6	169	24	31	20	330	15.8	13.9					16.0	18.2	16.3
46003	51.9N	155.7W	740	31	1029.9	31	19	963.6	10	10	994.4	728	36	01	00	180	13.6	19.3	19.2	18.9	18.1	14.5	13.6	13.1	17.1
46005	46.1N	131.0W	744	31	1036.2	30	20	1003.8	08	22	1021.6	739	29	04	14	160	17.0	6.6	10.2	15.5	18.4	13.1	14.1	16.7	16.3
46006	40.7N	137.7W	741	31	1041.4	31	20	990.6	23	12	1017.8	740	41	23	10	160	8.6	12.8	11.4	17.3	20.3	17.3	18.1	13.5	17.6
46010	46.2N	124.2W	144	06	1029.1	30	18	1018.4	28	02	1024.2	141	17	28	04	090	7.0	6.0	9.6	6.2	5.8	4.8	4.0	7.4	07.7
46011	34.9N	120.9W	743	31	1028.6	02	18	1015.7	08	12	1021.2	703	22	07	17	150	7.6	7.8	4.4	6.1	6.9	4.7	5.6	10.4	07.9
46012	37.4N	122.7W	738	31	1027.9	02	18	1013.2	07	23	1021.2	738	26	31	13	340	11.6	8.5	7.4	7.0	9.7	6.3	4.5	10.5	09.7
46013	38.2N	123.3W	736	31	1028.3	11	19	1012.4	07	23	1021.3	717	26	31	14	320	5.7	5.3	8.8	5.8	5.0	4.2	4.5	11.0	08.3
46014	39.2N	124.0W	737	31	1029.1	02	19	1011.9	07	14	1021.5	705	29	31	00	330	11.2	4.3	4.9	7.3	8.0	3.8	4.6	11.8	07.8
46016	63.3N	170.3W	242	31	1015.2	25	21	967.5	02	06	998.2	244	53	11	06	030	3.0	26.6	18.9	17.7	17.1	20.7	10.5	19.0	23.7
46017	60.3N	172.3W	243	31	1008.7	25	21	961.8	01	15	993.5	243	37	09	21	040	26.2	21.9	19.4	15.3	24.7	21.3	12.9	7.5	20.0
46018	60.3N	177.0W										244	42	07	12	040	24.2	27.5	22.5	15.3	18.3	20.9	15.7	19.5	24.1
46022	40.8N	124.5W	740	31	1029.8	11	18	1010.3	07	07	1022.3	718	25	30	13	350	11.1	4.5	3.9	6.2	8.5	7.6	4.4	7.3	07.7
46023	34.3N	120.7W	628	27	1026.0	17	18	1014.5	28	00	1019.6	619	24	14	10	320	10.7	5.9	6.4	7.4	5.5	2.0	5.9	12.5	10.4
46024	32.8N	119.5W	741	31	1026.9	02	18	1015.0	31	23	1019.8	711	24	30	15	310	6.7	6.8	5.4	5.5	6.0	4.7	7.9	12.0	08.9
46025	33.6N	119.0W	743	31	1026.6	02	17	1013.7	28	23	1019.1	712	27	12	21	020	7.3	7.7	5.5	5.2	2.9	3.8	7.9	7.2	06.7
46028	35.8N	121.7W	610	31	1028.6	02	18	1015.8	27	22	1021.7	574	25	31	21	310	5.4	3.0	4.5	5.4	4.3	4.6	6.6	10.7	07.6
46029	46.2N	124.2W	743	31	1035.4	01	01	1013.0	27	13	1023.4	734	22	06	16	070	6.5	10.8	12.1	7.7	10.5	7.0		7.5	11.0
46030	40.4N	124.5W	742	31	1028.9	11	20	1010.5	27	05	1021.7	742	29	07	08	140	12.5	5.4	2.6	9.0	10.0	2.3	4.3	6.3	09.5
46031	55.5N	161.7W	247	31	1015.8	31	21	965.8	01	03	990.6	247	43	17	12	150	7.0	12.9	13.5	21.7	18.2	12.8	6.6	6.4	16.2
46032	54.2N	165.8W										217	41	17	21	140	11.2	15.3	23.0	20.5	12.3	12.2	7.9	11.3	17.0
46034	55.1N	163.1W	248	31	1016.4	31	13	964.6	01	04	991.4	248	48	17	10	150	10.8	18.6	20.2	25.6	19.1	18.3	11.2	9.0	20.2
51001	23.4N	162.3W	740	31	1021.5	05	21	997.8	14	05	1015.3	735	34	14	05	230	13.3	10.8	11.0	9.3	11.7	13.5	15.8	15.5	12.9
51002	17.2N	157.8W	742	31	1020.2	21	21	1006.5	15	01	1015.0	737	26	06	06	080	9.6	11.0	13.4	7.1	9.4	12.1	8.3	12.6	12.0
51003	19.2N	160.8W	743	31	1019.5	21	20	1004.4	14	15	1014.8	728	24	14	15	240	13.6	8.4	9.9	9.5	7.9	11.6	7.7	16.6	10.1
51004	17.5N	152.5W	743	31	1019.2	20	20	1005.8	15	01	1014.6	741	22	06	05	070	11.7	12.1	12.2	8.7	12.3	19.0	10.0	7.2	11.9
ALRF1	25.1N	080.7W	742	31	1027.0	22	14	1010.2	18	22	1019.1	742	34	01	05	110	12.5	5.5	15.6	16.3	15.1	12.0	8.6	12.8	12.6
ALSN6	40.5N	073.8W	741	31	1032.8	10	12	995.3	15	05	1012.9	741	40	21	02	310	21.2	11.9	10.9	11.2	7.8	10.1	14.5	22.8	18.2
BURL1	28.9N	089.4W	741	31	1036.4	21	15	1010.5	31	21	1021.5	741	36	20	14	340	15.4	9.7	8.8	16.2	14.7	8.9	14.4	13.5	13.9
CAR03	43.1N	124.4W	742	31	1031.6	01	02	1012.3	07	06	1023.1	742	25	21	02	020	11.5	6.9	3.3	4.6	7.3	7.6	2.8	8.7	06.3
CHLV2	36.9N	075.7W	717	31	1033.3	10	01	999.6	05	01	1015.6	720	44	26	10	310	18.1	21.0	13.0	10.8	13.3	13.7	17.9	23.1	18.0
CLKN7	34.6N	079.8W	737	31	1031.6	10	00	1001.5	04	21	1016.5	736	30	20	16	260	12.9	12.1	2.8	7.6	10.1	14.2	16.9	14.2	13.9
CSBF1	29.7N	085.4W	740	31	1033.3	21	15	1011.1	17	17	1020.6	741	25	04	14	280	5.2	3.4	4.9	4.5	8.3	6.9	12.0	6.8	06.3
DBLN6	42.6N	079.5W	640	29	1034.7	10	01	994.0	19	17	1013.6	640	43	20	21	270	7.2	8.3	9.1	4.3	5.2	19.5	20.2	15.1	15.8
DESW1	47.7N	124.5W	740	31	1037.1	01	06	1014.5	07	22	1023.9	739	28	14	12	140	4.4	4.4	3.8	9.5	6.5	5.7	4.6	5.3	06.0
DISW3	47.1N	090.7W	742	31	1034.6	11	09	992.9	14	02	1017.5	740	36	12	18	220	15.6	20.6	8.1	2.4	6.6	18.0	15.3	18.5	15.3
DSLN7	35.2N	075.3W	695	31	1030.8	10	01	999.9	04	22	1014.8	697	47	20	16	230	18.4	11.7	6.6	18.1	24.8	23.7	24.1	20.2	21.8
FBIS1	32.7N	079.9W	738	31	1028.5	16	16	1004.2	17	19	1017.3	739	20	09	19	060	6.8	11.1	8.2	5.1	5.5	9.2	6.3	6.4	07.2
FFIA2	57.3N	133.6W	743	31	1032.4	31	02	998.0	16	18	1017.6	742	34	02	21	160	9.6	3.7	4.8	16.2	12.8	10.3	4.0	2.9	11.1
FPSN7	33.5N	077.6W	731	31	1029.6	16	16	1003.0	04	19	1017.5	732	41	15	03	260	15.7	12.2	9.4	15.1	17.6	23.9	21.5	17.4	18.6
GDIL1	29.3N	089.9W	740	31	1036.8	21	15	1009.0	31	21	1021.4	739	34	20	13	360	17.8	10.6	8.1	8.1	10.1	6.4	8.8	9.3	11.1
GLLN6	43.5N	076.3W	741	31	1033.8	03	07	991.5	19	18	1011.1	741	43	21	08	250	8.3	10.3	6.1	13.9	16.2	21.5	20.6	13.1	14.7
IOSN3	42.9N	070.6W	735	31	1030.1	03	15	990.2	22	19	1007.9	738	39	16	16	310	9.9	12.2	12.8	5.6	5.9	18.5	19.6	15.3	16.2
LKWF1	26.7N	080.0W	740	31	1027.9	22	15	1009.5	18	21	1019.5	740	22	02	07	130	9.1	6.2	8.1	13.6	13.8	6.4	5.1	7.1	08.2
MDRM1	44.0N	068.1W	740	31	1029.7	01	13	986.3	21	04	1006.0	740	39	09	17	300	16.4	16.0	13.4	13.5	10.7	15.7	23.9	22.1	19.9
MISM1	43.8N	068.9W	740	31	1029.6	01	06	987.5	20	03	1006.8	657	45	23	07	260	13.0	14.9	14.7	13.4	11.7	20.8	25.4	19.9	20.4
NWPO3	44.6N	124.1W	503	22	1030.4	30	18	1016.9	22	12	1023.4	109	22	14	17	200		4.9	9.9	3.2	14.5	9.7			09.9
PILM4	48.2N	088.4W	717	31	1032.3	10	16	989.6	14	02	1015.0	718	32	12	08	260	10.3	18.3	6.6	9.5	10.0	17.2	16.1	12.9	13.7
PTAC1	38.9N	123.7W	741	31	1028.9	02	18	1012.8	07	13	1021.9	738	30	31	04	010	11.4	7.0	3.4	5.3	6.8	2.0	3.1	4.8	06.4
PTAT2	27.8N	097.1W	725	31	1039.9	21	16	1005.4	31	09	1022.0	724	36	20	11	350	15.5	9.5	7.7	9.3	8.0	5.8	6.4	12.1	11.7
PTGC1	34.6N	120.7W	739	31	1028.1	02	17	1015.3	31	22	1020.6	737	28	07	16	140	10.0	6.4	3.3	5.7	4.4	2.1	3.9	11.7	08.4
SPID1	41.7N	082.8W	468	23	1028.2	16	14	995.0	18	20	1012.7	468	34	15	02	320	8.9	5.5	7.0	9.3	8.0	18.8	21.2	16.6	16.3
SSNM3	43.8N	087.7W	398	19	1027.0	16	02	995.1	14	11	1012.0	697	35	01	11	020	14.6	19.8	16.4	16.8	9.5	8.7	13.4	12.6	12.6
STSW1	48.3N	122.9W	738	31	1039.8	01	03	1015.1	14	13	1025.4	742	29	14	19	150	4.9	3.2	4.3	5.9	6.2	3.8	7.2	3.5	04.6
SJLF1	30.4N	081.4W	738	31	1028.4	21	14	1006.9	17	21	1019.2	739	20	04	19	280	10.4	5.6	5.0	8.1	7.6	8.2	9.2	9.0	08.6
SRST2	29.7N	094.1W	741	31	1039.2	21	15	1008.0	31	09	1022.4	740	27	20	10	360	10.7	7.8	10.9	10.6	8.4	9.4	6.4	7.0	09.3
STDM4	47.2N	087.2W										738	44	14	12	360	21.7	20.7	23.0	21.4	10.4	11.0	16.7	20.1	19.2
TTIW1	48.3N	124.7W	676	29	1031.3	12	06	1014.0	07	15	1023.6	675	33	22	16	070	4.8	14.0	15.5	7.6	8.1	8.4	9.2	6.9	14.0
WPOW1	47.7N	122.4W	741	31	1035.2	01	04	1015.3	07	22	1025.4	741	23	14	22	180	8.1	4.2	1.7	4.1	5.9	3.1	0.9	2.5	05.3

JANUARY 1985

TOTAL FREQUENCY OF WIND SPEEDS (%)

BUOY	LAT	LONG	CALM	<6KT	6-10KT	11-21KT	22-33KT	34-47KT	>47KT
32301	-0. N	105.0W			54.8	45.2			
41001	34.9N	072.9W		0.7	4.5	30.6	50.7	11.6	
41002	32.3N	075.3W		0.7	13.1	52.7	33.3	0.3	
41006	29.3N	077.3W		5.6	17.5	55.1	21.8		
42001	25.9N	089.7W		3.7	27.7	54.3	14.1	0.3	
42002	26.0N	093.5W		5.1	25.4	55.5	14.0		
42003	26.0N	085.9W		1.2	17.8	59.1	21.9		
42007	30.1N	088.9W		6.2	38.9	52.3	2.6		
44004	38.5N	070.7W		1.2	9.3	35.7	42.6	13.2	
44005	42.7N	068.4W		3.5	21.0	49.7	25.7		
44007	43.5N	070.1W		4.0	32.8	52.6	10.6		
44008	40.5N	069.4W	0.7	7.6	51.8	40.6			
44011	41.1N	066.6W		3.9	17.7	45.3	33.1		
44012	38.8N	074.6W	4.5	4.2	19.0	46.2	29.0	1.6	
44013	42.4N	070.8W	2.0	4.3	29.1	45.7	20.9		
46001	56.3N	148.3W		3.3	19.5	60.4	16.7	0.1	
46002	42.5N	130.3W			3.6	87.6	8.9		
46003	51.9N	155.7W		1.9	14.7	55.5	27.5	0.4	
46005	46.1N	131.0W		2.4	18.9	56.4	22.2		
46006	40.7N	137.7W		1.6	13.9	57.6	25.8	1.1	
46010	46.2N	124.2W		14.2	58.9	27.0			
46011	34.9N	120.9W		18.9	51.9	29.0	0.1		
46012	37.4N	122.7W		12.7	44.2	40.8	2.3		
46013	38.2N	123.3W		13.8	56.8	27.9	1.5		
46014	39.2N	124.0W		21.8	52.6	21.8	3.7		
46016	63.3N	170.3W		0.4	6.1	31.6	49.6	11.9	0.4
46017	60.3N	172.3W		0.8	8.6	51.0	38.3	1.2	
46018	60.3N	177.0W		0.4	4.1	70.3	54.9	10.2	
46022	40.8N	124.5W		19.8	57.8	20.5	1.9		
46023	34.3N	120.7W		12.6	36.2	50.2	1.0		
46024	32.8N	119.5W		15.0	47.7	37.0	0.3		
46025	33.6N	119.0W		23.7	60.0	16.2	0.1		
46026	35.8N	121.7W		25.8	44.9	28.7	0.5		
46029	46.2N	124.2W		5.3	38.6	56.0	0.1		
46030	40.4N	124.5W	6.7	13.6	46.9	35.6	3.9		
46031	55.5N	161.7W	0.4	6.5	28.7	36.4	21.9	6.5	
46032	54.2N	165.8W			29.5	42.4	22.6	5.5	
46034	55.1N	163.1W			16.9	42.3	32.3	8.1	0.4
51001	23.4N	162.3W		1.6	33.7	57.0	7.6	0.1	
51002	17.2N	157.8W		6.9	28.0	62.8	2.3		
51003	19.2N	160.8W		6.9	52.2	39.8	1.1		
51004	17.5N	152.5W		4.2	34.7	60.7	0.4		
ALRF1	25.1N	080.7W	0.9	4.4	33.6	57.3	4.6	0.1	
ALSN6	40.5N	073.8W	1.6	3.9	18.9	39.3	33.5	4.5	
BURL1	28.9N	089.4W	1.1	4.7	28.5	52.9	13.5	0.4	
CAR03	43.1N	124.4W	8.0	29.0	50.9	18.9	1.2		
CMLV2	36.9N	075.7W	2.1	4.6	13.3	50.0	28.5	3.6	
CLKN7	34.6N	077.0W	1.6	5.8	23.0	60.6	10.6		
CSBF1	29.7N	085.4W	3.6	25.6	61.4	11.3	1.6		
DBLN6	42.6N	079.5W	0.9	7.3	25.5	39.1	24.5	3.6	
DESW1	47.7N	124.5W	8.4	29.8	54.1	14.5	1.6		
DISW3	47.1N	090.7W	2.0	8.0	21.4	49.9	19.7	1.1	
DSLN7	35.2N	075.7W	0.9	2.2	9.9	40.2	38.0	9.8	
FRI51	32.7N	079.9W	2.0	18.7	62.0	18.9			
FFIA2	57.3N	133.6W	5.7	13.9	36.7	39.4	10.0	0.1	
FPSN7	33.5N	077.6W	1.4	4.6	11.9	49.0	30.1	4.4	
8DIL1	29.3N	089.9W	1.5	8.4	47.8	34.5	9.2	0.1	
8LLN6	43.5N	076.3W	0.3	5.8	30.8	41.2	19.4	2.8	
IOSN3	42.9N	070.6W	2.8	7.2	21.1	41.2	29.3	1.2	
LKWF1	26.7N	080.0W	2.4	14.1	59.3	26.5	0.1		
MDRM1	44.0N	068.1W	1.9	4.3	12.2	39.5	37.0	7.0	
MISM1	43.8N	068.9W		1.7	15.5	39.9	33.6	9.3	
NWP03	44.6N	124.1W	0.9	5.5	52.3	41.3	0.9		
PILM4	48.2N	088.4W	1.5	5.8	28.4	50.8	14.9		
PTAC2	38.9N	123.7W	12.2	29.7	51.1	17.6	1.6		
PTAT2	27.8N	097.1W	1.1	7.3	44.3	39.9	7.9	0.6	
PTGC1	34.6N	120.7W	8.1	19.3	46.9	31.3	2.4		
SBI01	41.7N	082.8W	3.4	5.6	23.7	43.4	26.5	0.9	
SGNW3	43.8N	087.7W	1.0	4.9	36.0	50.1	8.9	0.1	
SISW1	48.3N	122.9W	11.1	38.1	36.7	4.6	0.5		
SJLF1	30.4N	081.4W	1.4	8.7	58.6	32.7			
SRST2	29.7N	094.1W	1.4	9.3	54.1	35.3	1.4		
STOM4	47.2N	087.2W		1.1	10.3	50.7	35.6	2.3	
TTIW1	48.3N	124.7W	3.1	9.9	29.3	34.7	24.1		
WPOW1	47.7N	122.4W	13.2	40.5	46.4	12.8	0.3		

TOTAL FREQUENCY OF WIND DIRECTIONS (%)

BUOY	N	NE	E	SE	S	SW	W	NW
32301		0.3	34.2	65.5				
41001	5.4	0.7	0.2	2.3	17.2	11.1	34.9	28.2
41002	5.1	3.9	3.3	3.3	13.4	15.4	31.8	23.7
41006	9.5	2.4	3.1	6.2	9.6	13.4	32.1	23.9
42001	18.7	17.1	11.1	11.7	12.4	6.9	6.5	15.2
42002	8.5	25.8	14.7	13.6	11.0	3.9	8.3	14.3
42003	23.4	13.2	8.5	15.9	10.7	5.6	6.4	16.4
42007	18.4	19.6	7.6	7.8	8.1	9.2	13.3	15.9
44004	11.3	7.3	1.6	0.8	4.2	4.0	26.6	42.3
44005	9.1	4.9	4.1	3.2	3.0	6.5	29.1	45.1
44007	21.8	6.2	1.0	0.7	0.4	8.7	32.0	29.3
44008	9.7	6.3	5.6	2.4	3.0	3.9	24.5	44.6
44011	12.3	12.9	5.1	3.7	2.2	6.3	21.8	35.8
44012	18.0	14.3	5.3	1.7	2.4	10.3	14.9	29.2
44013	6.3	3.0	4.6	1.1	3.6	12.9	32.6	35.9
46001	0.8	4.0	15.7	26.8	23.9	19.5	7.4	1.9
46002	66.0	7.0					1.3	25.7
46003	3.1	3.9	9.3	24.7	29.2	16.9	10.1	2.9
46005	16.0	1.8	2.8	22.9	33.6	8.3	4.6	10.3
46006	1.4	6.6	8.7	16.7	43.3	9.5	8.7	5.1
46010	13.5	14.9	42.6	13.7	3.0	5.1	0.7	6.7
46011	16.4	18.5	8.3	11.4	4.7	3.1	5.8	31.8
46012	41.2	15.8	13.9	4.4	5.4	2.6	2.5	11.9
46013	6.8	7.4	46.4	5.8	3.1	2.4	3.1	25.2
46014	16.4	9.5	21.6	17.9	13.5	2.9	2.4	15.8
46016	0.3	66.2	14.0	8.6	6.5	2.4	0.8	1.2
46017	2.9	34.8	33.8	14.5	7.3	3.0	2.1	1.4
46018	9.1	49.9	31.1	7.0	3.1	1.9	1.0	1.8
46022	26.8	7.9	7.7	25.7	18.9	8.2	2.7	5.1
46023	21.0	2.9	8.6	9.7	1.6	1.2	4.3	50.8
46024	13.7	11.9	5.4	4.2	4.5	3.0	16.1	41.3
46025	8.5	16.1	12.0	10.3	4.0	4.4	22.8	22.1
46026	6.8	2.6	7.5	13.9	8.4	6.1	10.0	44.7
46029	6.8	5.1	58.9	6.9	5.1	2.4		3.4
46030	37.2	10.6	3.1	23.7	17.1	1.8	1.9	4.6
46031	6.2	2.9	7.2	32.7	32.0	4.3	3.9	10.8
46032	4.4	5.3	13.9	41.4	13.1	13.6	4.5	3.8
46034	4.6	8.9	12.4	37.6	23.0	2.2	6.0	5.2
51001	13.0	10.3	8.3	6.2	18.6	20.1	10.6	12.8
51002	4.7	11.7	40.5	10.9	2.2	3.9	1.6	4.5
51003	6.7	13.8	28.2	26.2	7.3	10.1	2.6	5.1
51004	1.4	27.5	47.3	11.2	7.4	2.2	2.3	0.8
ALRF1	25.6	2.2	10.5	10.6	3.8	8.8	16.6	21.8
ALSN6	21.5	11.0	3.6	2.3	0.6	6.7	17.0	37.2
BURL1	34.1	5.2	4.5	10.1	6.0	6.9	15.7	18.1
CAR03	5.5	18.8	59.9	6.9	5.1	2.4	1.7	1.1
CMLV2	17.3	5.6	1.0	1.9	8.5	17.4	25.9	22.5
CLKN7	19.8	8.5	1.7	1.5	4.2	12.6	24.5	27.0
CSBF1	25.8	13.7	11.2	9.5	4.0	4.1	15.2	16.5
DBLN6	4.7	3.2	6.1	5.4	6.1	39.3	21.8	13.4
DESW1	8.4	17.7	17.5	25.7	13.8	3.1	4.3	9.0
DISW3	10.3	4.5	0.7	3.9	13.0	21.8	23.2	20.6
DSLN7	20.5	3.4	0.6	2.6	2.1	12.9	27.9	29.9
FRI51	16.9	10.4	3.8	1.7	6.5	11.7	31.0	17.5
FFIA2	28.0	12.0	4.3	32.9	16.3	1.9	1.0	3.5
FPSN7	12.6	7.4	3.2	1.1	8.7	11.9	31.6	23.4
8DIL1	22.3	17.8	7.2	5.8	9.1	4.4	15.3	18.2
8LLN6	14.0	14.5	6.4	4.0	5.6	13.1	24.9	17.6
IOSN3	14.5	3.3	2.4	0.5	1.1	11.5	37.2	29.5
LKWF1	8.2	1.2	2.5	10.6	8.4	16.2	12.8	40.1
MDRM1	15.7	6.2	4.9	2.7	2.1	4.6	17.5	46.2
MISM1	4.0	7.1	6.2	2.2	1.3	6.0	30.0	43.3
NWP03		3.2	79.4	3.0	8.5	6.0		
PILM4	20.3	7.6	1.3	0.3	1.8	8.1	22.1	38.4
PTAC2	18.9	9.6	22.0	21.2	18.4	5.3	0.6	3.8
PTAT2	37.1	10.4	3.9	10.6	7.7	4.0	6.9	19.5
PTGC1	49.6	9.6	1.6	10.0	15.1	0.9	0.5	12.6
SBI01	6.1	1.1	5.8	3.3	9.4	27.1	29.9	17.0
SGNW3	8.4	3.6	1.9	1.2	4.3	17.1	34.8	28.7
SISW1	22.2	17.8	21.6	19.1	7.4	3.8	1.2	6.8
SJLF1	6.8	4.7	2.8	4.3	10.7	10.7	32.0	28.0
SRST2	35.5	8.8	8.2	9.1	6.6	6.7	10.1	15.0
STOM4	26.2	7.6	3.3	2.1	1.8	6.4	22.1	30.4
TTIW1	8.4	15.9	67.8	3.9	4.0	2.9	1.5	1.6
WPOW1	27.2	24.4	4.6	13.2	21.9	4.9	1.8	2.1

JANUARY 1985

WAVE HEIGHTS (METERS)

BUOY	LAT	LONG	OBS	MAX	DY	HR	MEAN
41001	34.9N	072.9W	594	6.5	15	20	1.2
41006	29.3N	077.3W	742	5.5	26	13	2.2
42001	25.9N	089.7W	725	4.5	21	08	1.3
42002	26.0N	093.5W	683	5.0	20	23	1.5
42003	26.0N	085.9W	743	4.0	04	05	1.3
42007	30.1N	088.9W	555	1.5	02	17	0.6
44004	38.5N	070.7W	667	7.0	16	01	2.9
44005	42.7N	068.4W	736	6.0	16	20	2.4
44007	43.5N	070.1W	621	3.0	02	04	0.8
44008	40.5N	069.4W	741	4.5	16	14	2.5
44011	41.1N	066.6W	516	7.5	09	21	3.4
46001	56.3N	148.3W	740	11.0	10	19	4.0
46002	42.5N	130.3W	169	4.0	28	10	2.5
46003	51.9N	155.7W	739	9.0	13	03	4.4
46005	46.1N	131.0W	436	5.0	17	02	3.0
46006	40.7N	137.7W	740	7.5	04	18	3.5
46010	46.2N	124.2W	104	2.5	26	03	1.8
46011	34.9N	120.9W	743	4.0	08	02	2.1
46012	37.4N	122.7W	735	4.0	21	06	2.1
46013	38.2N	123.3W	710	4.5	21	06	2.3
46014	39.2N	124.0W	730	4.5	17	10	2.2
46022	40.8N	124.5W	739	4.5	10	01	2.4
46023	34.3N	120.7W	627	4.0	08	06	2.3
46024	32.8N	119.5W	740	4.0	21	09	2.0
46025	33.6N	119.0W	742	5.0	08	21	1.4
46026	35.8N	121.7W	533	4.5	17	14	2.3
46029	46.2N	124.2W	742	4.0	17	11	2.1
51001	23.4N	162.3W	740	10.0	14	19	4.4
51002	17.2N	157.8W	742	5.5	15	11	2.6
51003	19.2N	160.8W	742	6.0	15	06	2.7
CMLV2	36.9N	075.7W	724	3.5	03	22	1.1
FBIS1	32.7N	079.9W	123	0.0	00	00	0.0

FREQUENCY OF WAVE HEIGHTS (%)

BUOY	<1M	1-1.5M	2-2.5M	3-3.5M	4-5.5M	6-7.5M	8-9.5M	>9.5M
41001		15.1	22.8	26.2	34.0	1.6		
41006		32.4	40.8	19.5	7.1			
42001	25.9	52.6	10.8	8.4	2.0			
42002	18.7	51.0	17.4	8.1	4.5			
42003	17.0	58.0	19.1	5.6	0.1			
42007	65.4	34.5						
44004		20.9	34.3	17.2	22.4	4.9		
44005	5.2	30.4	30.5	13.7	19.8	0.1		
44007	58.9	39.9	4.5	0.8				
44008		21.1	36.8	31.9	9.9			
44011		14.9	29.4	21.1	21.5	12.9		
46001			9.7	34.7	47.8	5.9	1.3	0.4
46002		0.8	49.8	28.4	1.1			
46003			8.6	23.0	50.7	16.2	1.3	
46005		8.4	22.0	49.0	20.4			
46006		10.6	17.1	27.4	38.6	6.0		
46010		36.8	63.1					
46011		29.6	51.2	17.6	1.4			
46012		30.2	54.9	14.6	0.1			
46013		21.6	51.6	22.8	3.8			
46014		25.0	54.6	18.9	1.3			
46022		15.2	54.8	23.6	6.0			
46023		16.7	59.2	21.4	0.7			
46024		27.9	60.9	10.9	0.1			
46025	5.2	75.2	19.0	0.5				
46026		21.5	51.9	24.9	1.5			
46029		22.7	52.1	17.8	2.2			
51001		11.0	25.2	27.8	29.3	4.4	1.7	0.2
51002		8.4	52.5	26.6	12.2			
51003		13.7	43.7	26.2	16.4	0.2		
CMLV2	31.9	52.2	13.3	2.4				
FBIS1								90.2

FEBRUARY 1985			AIR TEMPERATURE (DEG C)							SEA TEMPERATURE (DEG C)							AIR-SEA TEMPERATURE DIFFERENCE (DEG C)						
BUOY	LAT	LONG	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN
41002	32.3N	075.3W								670	28	22.8	17 11	18.4	13 13	20.1							
41006	29.3N	077.3W								672	28	24.4	26 19	21.3	19 11	22.8							
42001	25.9N	089.7W								671	28	24.4	27 20	20.4	16 14	21.8							
42002	26.0N	093.5W								015	01	22.1	01 02	21.6	01 14	21.9							
42003	26.0N	085.9W								670	28	27.0	27 22	24.0	14 10	25.2							
42007	30.1N	088.9W								667	28	17.5	26 22	08.6	14 10	12.2							
44004	38.5N	070.7W								656	28	19.8	01 01	11.6	15 09	14.4							
44005	42.7N	068.4W								659	28	06.5	02 22	05.6	20 17	06.0							
44007	43.5N	070.1W								643	28	06.3	02 02	01.5	16 19	03.2							
44008	40.5N	069.5W								117	06	06.2	02 15	03.9	01 00	05.3							
44009	38.5N	074.6W								057	03	04.8	28 20	04.0	26 14	04.4							
44011	41.1N	066.6W								058	03	05.4	28 13	04.9	26 14	05.2							
44012	38.8N	074.6W								278	12	05.1	28 19	01.6	20 09	03.4							
44013	42.4N	070.8W								671	28	03.6	11 20	01.6	15 17	02.6							
46001	56.3N	148.3W								670	28	05.8	01 06	04.5	17 10	05.0							
46002	42.5N	130.3W								672	28	10.5	04 01	10.0	27 01	10.2							
46003	51.7N	155.7W								671	28	04.8	03 03	03.9	18 05	04.3							
46004	50.7N	135.9W								460	20	07.0	09 21	06.6	24 11	06.8							
46005	46.1N	130.9W								671	28	09.5	01 02	08.8	18 09	09.1							
46006	40.8N	137.6W								672	28	13.9	23 00	12.9	22 11	13.2							
46010	46.2N	124.2W								666	28	08.7	11 22	04.7	25 15	06.8							
46011	34.9N	120.9W								671	28	13.6	01 22	11.8	21 12	12.6							
46012	37.4N	122.7W								668	28	12.8	15 01	11.4	21 08	11.8							
46013	38.2N	123.3W								669	28	11.5	01 01	09.4	23 11	10.6							
46014	39.2N	124.0W								671	28	11.9	10 22	09.3	26 12	10.7							
46018	60.3N	177.0W								046	06	01.7	01 03	01.7	01 00	01.7							
46022	40.8N	124.5W								671	28	10.9	02 22	08.9	27 10	10.1							
46023	34.3N	120.7W								671	28	15.1	14 22	12.0	10 13	12.8							
46024	32.8N	119.5W								671	28	15.5	14 23	13.0	05 05	13.6							
46025	33.6N	119.0W								671	28	15.6	15 00	13.3	08 11	14.0							
46026	37.8N	122.7W								316	14	12.6	23 21	10.6	21 16	11.5							
46028	35.8N	121.9W								072	03	12.6	02 00	12.2	03 15	12.4							
46029	46.2N	124.2W								670	28	08.5	14 23	05.0	01 07	06.8							
46032	54.2N	165.8W								196	28	06.3	13 21	03.0	18 21	03.9							
46033	55.8N	159.8W								015	02	02.4	27 06	02.0	27 18	02.2							
46034	55.1N	163.1W								048	07	02.9	23 01	02.5	25 07	02.7							
51001	23.4N	162.3W								672	28	24.5	22 00	23.5	02 09	24.0							
51002	17.2N	157.8W								669	28	25.0	28 01	24.0	10 17	24.4							
51003	19.2N	160.8W								671	28	25.4	23 02	24.4	05 09	24.8							
51004	17.5N	152.5W								669	28	24.2	01 01	23.3	26 12	23.8							
ALRF1	25.0N	080.6W								671	28	24.6	07 20	19.8	16 08	22.7							
ALSN6	40.5N	073.8W								669	28	03.5	02 11	00.0	14 18	02.0							
CHLV2	36.9N	075.7W								651	28	06.4	27 19	01.5	09 14	04.0							
FPSN7	33.5N	077.6W								605	27	19.6	04 12	10.8	01 15	15.7							
GDIL1	29.3N	090.0W								667	28	19.0	27 09	07.1	03 16	13.7							
LKWF1	26.6N	080.0W								669	28	23.9	28 03	20.1	13 11	22.2							

FEBRUARY 1985			PRESSURE (MB)							WIND SPEEDS (KNOTS)				MEAN WIND SPEED (KNOTS)								
BUOY	LAT	LONG	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN	OBS	MAX	DY HR	DIR	N	NE	E	SE	S	SW	W	NW	TOTAL
41002	32.3N	075.3W	670	28	1035.7	22 16	1001.9	12 11	1021.6	669	37	12 10	150	12.3	14.0	11.6	14.4	15.2	16.3	16.2	16.4	15.1
41006	29.3N	077.3W	672	28	1030.7	22 16	1004.9	12 09	1021.6	667	33	12 11	250	11.5	10.8	13.2	11.6	13.5	13.2	15.3	11.5	12.9
42001	25.9N	089.7W	279	12	1024.8	08 16	1008.6	01 21	1016.7	671	38	11 22	320	13.5	14.1	12.4	12.9	11.6	9.1	13.5	22.2	13.9
42002	26.0N	093.5W	671	28	1030.9	12 16	1006.7	01 01	1020.1	670	36	11 19	360	21.9	16.7	14.8	14.9	9.9	7.8	15.5	17.8	15.7
42003	26.0N	085.9W	670	28	1026.1	18 16	1010.6	01 21	1019.9	669	35	11 14	190	14.8	17.8	17.9	18.8	22.6	22.6	15.0	23.0	18.7
42007	30.1N	088.9W	669	28	1032.6	08 17	1008.7	01 10	1021.5	419	23	02 14	020	10.9	11.2	11.1	10.1	12.5	4.5	3.9	7.0	10.4
44004	38.5N	070.7W	656	28	1036.2	22 02	1001.0	06 12	1019.1	657	46	09 03	300	14.8	13.6	19.0	23.5	15.4	15.4	17.3	21.6	18.0
44005	42.7N	068.4W	659	28	1035.6	21 15	996.6	09 06	1017.3	652	32	28 04	310	12.3	14.0	15.4	13.0	12.9	14.0	15.5	15.0	14.3
44007	43.5N	070.1W	646	28	1035.0	21 14	998.7	08 20	1017.3	636	30	13 07	100	10.9	9.1	12.9	11.1	13.4	13.3	14.1	12.5	12.6
44008	40.5N	069.5W	117	06	1028.3	04 04	1005.4	27 22	1015.2	108	33	28 04	290	14.2	11.0	15.2			12.1	21.9	17.5	14.7
44009	38.5N	074.6W	057	03	1029.8	28 15	1014.0	27 19	1021.8	055	23	27 22	300	13.4	11.1	4.9	6.0	7.8	9.8	10.1	18.0	12.4
44011	41.1N	066.6W	058	03	1023.1	28 23	1003.5	27 22	1015.8	056	30	28 05	290	8.9	8.3	8.9	7.7	8.0	14.9	19.1	19.6	14.7
44012	38.8N	074.6W	278	12	1036.8	21 16	1011.1	25 03	1025.1	267	25	24 20	180	11.5	6.7	8.5	6.4	15.6	8.7	7.0	15.5	11.8
44013	42.4N	070.8W	671	28	1035.5	21 16	1001.2	08 21	1017.9	651	35	13 03	090	13.7	15.7	15.6	8.0	11.0	11.4	17.3	14.3	13.5
46001	56.3N	148.3W	671	28	1030.4	04 23	979.3	14 17	1007.8	666	36	06 05	300	14.6	13.2	8.8	9.9	12.6	17.2	17.4	16.3	15.7
46002	42.5N	130.3W	672	28	1036.9	25 20	1003.3	11 07	1024.5	671	33	11 05	190	12.3	10.6	5.0	7.5	20.8	17.1	14.4	14.5	14.2
46003	51.7N	155.7W	671	28	1041.7	05 21	985.7	17 06	1013.5	668	35	19 01	290	15.5	14.7	15.7	13.5	16.7	19.6	17.5	17.4	17.4
46004	50.7N	135.9W	460	20	1031.8	28 21	973.9	14 15	1013.7	460	36	14 19	250	22.9	15.1	9.7	13.4	19.8	17.2	17.0	19.5	17.2
46005	46.1N	130.9W	671	28	1036.7	25 06	991.2	11 10	1022.4	669	41	11 05	180	13.1	9.6		30.8	26.1	16.5	17.4	18.3	17.7
46006	40.8N	137.6W	672	28	1039.1	01 04	997.4	11 02	1027.1	672	36	14 08	240	12.2	10.2	5.6	13.1	18.2	14.9	11.6	12.2	12.8
46010	46.2N	124.2W	666	28	1035.6	25 19	997.6	08 10	1021.7	650	36	11 14	170	10.5	5.6	9.5	9.0	13.5	10.3	9.0	8.7	10.1
46011	34.9N	120.9W	671	28	1028.2	11 19	1009.3	21 01	1019.4	640	28	01 01	320	8.8	7.1	3.1	4.3	8.9	7.1	7.5	13.8	10.4
46012	37.4N	122.7W	668	28	1028.5	10 18	1011.5	08 14	1019.7	668	34	20 08	320	13.2	6.8	3.8	7.5	13.1	11.0	5.3	15.0	13.2
46013	38.2N	123.3W	669	28	1028.7	10 19	1009.5	08 12	1019.6	645	27	20 08	320	7.3	4.6	5.5	4.9	8.8	10.4	4.0	14.0	12.2
46014	39.2N	124.0W	671	28	1029.1	10 19	1007.7	08 08	1020.5	663	35	21 03	330	14.4	4.5	5.1	9.4	10.8	12.1	4.0	17.6	14.3
46016	63.3N	170.3W	220	28	1044.4	08 18	995.0	02 03	1021.5	209	40	15 09	020	16.6	17.5	8.8	17.3	17.5	12.9	13.1	11.6	15.8
46017	60.3N	172.3W	223	28	1045.4	08 12	983.2	02 03	1018.8	222	38	02 03	160	16.9	19.3	14.4	20.7	16.7	18.2	14.5	7.7	17.8
46018	60.3N	177.0W								209	43	02 00	130	19.1	20.5	17.1	20.0	20.5	21.7	19.9	14.9	19.7
46022	40.8N	124.5W	671	28	1030.0	24 19	1006.2	08 02	1021.9	656	30	02 02	350	15.0	5.4	3.3	8.3	15.5	9.0	7.1	9.6	13.3
46023	34.3N	120.7W	671	28	1027.3	11 19	1007.6	21 00	1018.7	665	29	01 03	330	11.3	5.6	6.3	7.9	7.5	11.1	8.2	15.2	13.1
46024	32.8N	119.5W	671	28	1025.4	10 19	1005.9	21 01	1018.0	654	29	20 23	300	7.3	5.3	4.8	3.9	4.1	7.8	8.8	12.4	10.1
46025	33.6N	119.0W	671	28	1025.1	10 19	1005.2	21 00	1017.2	647	26	21 16	360	7.7	5.8	4.0	3.9	3.1	6.3	7.3	7.9	06.6
46026	37.8N	122.7W	316	14	1026.3	24 19	1011.5	27 11	1017.9	310	28	20 04	300	6.0	4.2	2.7	4.6	9.1	2.4	9.2	14.2	11.4
46028	35.8N	121.9W	022	03	1021.1	01 18	1013.6	02 12	1017.3	022	25	01 00	320							14.0	17.1	16.8
46029	46.2N	124.2W	670	28	1035.5	25 19	997.5	06 10	1021.6	639	32	11 13	160	9.5	6.7	8.6	11.8	11.6	9.4	8.3	7.6	09.3
46030	40.4N	124.5W	670	28	1029.3	24 18	1006.6	08 03	1021.6	481	31	11 19	140	14.1	6.0	2.6	16.5	12.7	7.3	6.8	10.8	13.1
46031	55.5N	161.7W	223	28	1044.3	05 21	972.8	26 21	1012.7	224	39	27 03	300	16.2	7.5		20.2	18.3	12.3	14.9	13.0	14.6
46032	54.2N	165.8W	025	04	1017.7	28 12	971.4	26 18	996.7	193	40	01 06	140	23.1	14.9	14.8	18.6	11.6	12.5	11.1	19.6	16.8
46033	55.8N	159.8W	015	02	1021.2	28 21	974.6	27 03	1004.5	015	25	27 06	290	7.5	8.0				19.8	15.3	14.0	13.0
46034	55.1N	163.1W	048	07	1021.9	28 13	974.6	26 19	1002.2	048	31	26 19	200	9.0	11.5	17.7	17.2	17.1	23.0	13.6	13.0	16.5
51001	23.4N	162.3W	672	28	1020.4	22 21	1007.6	12 03	1016.0	670	26	28 08	080	9.8	13.6	12.9	11.1	11.9	14.3	10.7	10.5	12.5
51002	17.2N	157.8W	669	28	1017.7	01 20	1009.4	28 02	1013.8	669	24	08 13	120	8.1	11.4	14.4	12.9				2.6	13.6
51003	19.2N	160.8W	671	28	1017.7	01 08	1008.9	28 07	1013.8	671	20	27 12	050	10.5	10.5	10.3	11.4	12.2	8.2	11.8	5.3	10.7
51004	17.5N	152.5W	669	28	1016.9	07 20	1007.8	27 01	1013.6	667	23	28 22	060	3.5	14.3	13.9	11.2	9.3	4.1		3.5	13.4
ALRF1	25.0N	080.6W	671	28	1025.9	18 15	1013.0	12 07	1020.1	631	30	08 13	350	14.1	16.4	16.3	16.0	9.1	11.1	15.7	14.0	15.4
ALSN6	40.5N	073.8W	669	28	1036.3	21 16	999.5	12 22	1020.2	639	46	12 19	110	21.0	11.7	19.3	13.0	12.9	18.0	13.6	20.1	17.1
BURL1	28.9N	089.4W	670	28	1030.6	08 16	1008.8	11 08	1021.4	605	39	12 00	280	13.5	12.1	15.9	16.2	15.5	7.3	17.3	12.8	14.2
CARO3	43.4N	124.7W	670	28	1034.6	25 10	1000.2	07 21	1023.1	623	33	07 20	200	12.7	8.7	4.0	5.7	15.2	15.6	15.1	9.5	11.5
CHLV2	36.9N	075.7W	653	28	1036.7	21 16	996.3	12 14	1021.8	612	40	09 09	320	13.5	11.9	10.5	12.5	17.8	15.4	15.2	16.7	14.8
CLKN7	34.7N	079.9W	670	28	1035.1	21 16	996.8	12 09	1022.0	640	38	12 09	150	11.1	10.8	4.4	18.4	6.5	10.3	11.2	12.1	10.7
CSBF1	29.7N	085.4W	670	28	1030.0	08 14	1009.4	11 19	1022.1	650	28	12 02	280	4.2	3.4	5.8	3.6	6.5	3.9	13.1	8.1	05.8
DPLN6	42.5N	079.4W	454	23	1036.7	04 16	996.2	13 22	1022.2	454	37	13 22	230	4.7	7.9	3.8	6.9	5.7	16.3	13.3	7.3	12.7
DESW1	47.7N	124.5W	670	28	1034.9	25 19	998.0	08 02	1020.8	667	43	11 13	130	8.5	5.8	4.8	14.6	10.9	9.7	10.4	12.7	11.1
DISW3	47.1N	090.7W	670	28	1036.6	08 14	998.6	26 19	1020.8	651	33	28 17	220	11.0	10.0	6.0	4.2	6.0	12.3	12.5	11.8	09.9
DSLN7	35.2N	075.3W	668	28	1034.8	22 16	997.4	12 11	1020.8	621	57	12 10	140	18.4	13.7	5.6	27.4	15.1	21.7	16.0	14.5	17.5
FEIS1	32.7N	079.9W	667	28	1034.1	21 16	998.2	12 06	1021.4	647	22	12 06	220	6.3	10.2	8.2	7.2	7.0	7.3	6.5	5.0	07.5
FFIA2	57.3N	133.6W	668	28	1023.8	05 09	975.4	14 22	1010.2	636	48	11 21	340	20.4	5.9	6.3	18.4	15.0	12.9	4.8	17.3	16.1
FPSN7	33.5N	077.6W	658	28	1033.3	22 15	996.3	12 07	1021.3	642	49	12 06	140	17.5	16.8	6.3	14.8	16.3	18.5	15.4	14.6	16.2
GDIL1	29.3N	090.0W	669	28	1031.3	08 16	1008.6	01 10	1021.3	643	29	12 01	310	12.0	12.3	10.6	9.9	8.7	6.4	7.4	14.3	11.3
GLLN6	43.9N	076.4W	666	28	1033.1	04 16	995.7	13 08	1018.3	660	37	19 12	260	4.7	8.7	5.6	7.7	14.7	18.5	18.0	15.2	13.4
IOSN3	43.0N	070.6W	670	28	1034.5	21 16	999.9	08 21	1017.2	637	52	13 05	100	13.6	8.8	22.7	12.1	14.5	14.9	19.6	15.1	15.8
LKWF1	26.6N	080.0W	670	28	1027.4	18 16	1011.5	12 08	1021.1	654	29	12 01	180	10.3	11.5	12.6	11.1	14.5	6.0	7.0	6.5	10.9
MDRM1	44.0N	068.1W	671	28	1034.3	21 15	995.2	09 05	1016.8	650	49	13 12	110	17.0	16.3	21.3	14.2	17.1	18.8	17.0	19.2	18.1
MISM1	43.6N	068.9W	666	28	1034.8	21 15	997.0	09 06	1017.2	638	53	13 11	100	15.5	14.4	22.9	14.0	17.8	17.4	18.9	19.3	18.1
NWPO3	44.6N	124.1W	645	28	1035.5	25 18	999.7	08 10	1022.8	045	22	26 23	350	15.4	2.9	3.3					12.0	07.3
PILM4	48.2N	088.4W	008	01	1019.3	01 05	1018.7	01 07	1019.0	008	16	01 03	270						13.5	13.9	10.0	13.1
PTAC1	39.0N	123.7W	669	28	1029.0	10 19	1009.1	08 08	1020.6	578	32	21 02	010	12.2	7.0	3.0	6.8	9.7	14.1	6.8	12.2	09.9
PTAT2	27.8N	097.1W	669	28	1031.4	12 15	1010.3	23 05	1020.9	610	27	04 07	020	14.0	9.9	9.2	9.3	6.0	6.3	4.7	13.6	11.0
PTGC1	34.6N	120.7W	670	28	1027.0	11 19	1007.6	20 23	1018.7	528	38	20 23	330	13.7	7.1	5.7	5.1	7.6	4.2	7.1	17.7	12.4
SPID1	41.7N	082.8W	662	28	1037.0	04 16	992.3	13 05	1020.8	659	30	17 03	260	7.7	10.1	8.5	10.2	12.5	12.9	14.1	15.1	12.5
SGNW3	43.6N	087.7W	668	28	1035.9	04 17	1007.2	16 17	1019.6	651	32	19 01	290	15.8	15.1	12.1	14.3	13.1	11.0	9.6	11.9	12.0
SISW1	48.3N	122.9W	661	28	1035.0	25 19	998.6	08 02	1020.6	651	41	11 09	150	6.4	4.6	6.1	11.5	11.4	6.3	11.2	9.3	09.6
SJLF1	30.4N	081.4W	671	28	1031.1	18 16	1005.2	12 04	1022.0	659	26	12 11	270	9.0	10.4	7.1	7.0	8.7	7.9	10.8	6.1	08.7
SRST2	29.7N	094.1W	669	28	1032.9	08 16	1010.3	11 02	1022.0	614	23	11 14	330	9.6	8.6	9.1	11.7	6.9	6.7	6.4	10.6	09.4
STDM4	47.2N	087.2W								636	40	14 22	330	24.0	15.3	10.5	9.2	14.5	11.5	18.4	17.7	16.7
TTIW1	48.4N	124.7W	671	28	1035.3	25 19	998.2	11 15	1020.9	671	41	11 14	150	3.5	7.8	11.0	13.5	13.9	14.2	14.9	9.8	12.7
WPOW1	47.7N	122.4W	266	14	1035.6	25 18	1002.3	07 03	1023.1	256	24	07 00	180	7.7	3.2	2.6	6.3	8.7	5.8	3.0	5.2	06.6

FEBRUARY 1985 | TOTAL FREQUENCY OF WIND SPEEDS (%) | TOTAL FREQUENCY OF WIND DIRECTIONS (%)

BUOY	LAT	LONG	CALM	<4KT	4-10KT	11-21KT	22-33KT	34-47KT	>47KT	N	NE	E	SE	S	SW	W	NW
41002	32.3N	075.3W		1.3	18.4	69.7	10.3	0.3		4.1	10.2	9.8	11.9	13.6	21.3	13.4	15.7
41006	29.3N	077.3W		4.8	34.9	52.0	8.2			11.4	4.3	10.0	11.9	17.1	16.9	15.2	13.3
42001	25.9N	089.7W		3.1	32.9	50.7	12.1	1.2		8.6	29.2	21.9	19.5	9.4	0.5	1.9	9.1
42002	26.0N	093.5W		1.5	21.6	59.1	16.9	0.9		14.3	16.8	24.3	30.7	9.1	1.3	0.3	3.3
42003	26.0N	085.9W		1.2	15.7	42.3	40.5	0.3		10.5	18.1	29.2	21.7	10.7	1.5	0.9	7.4
42007	30.1N	088.9W		7.2	38.2	54.2	0.5			19.0	21.0	31.9	12.5	3.0	2.2	2.2	7.5
44004	38.5N	070.7W		1.7	16.9	54.9	23.1	3.3		18.7	4.6	7.3	4.0	4.3	9.4	24.4	27.3
44005	42.7N	068.4W		2.9	23.9	63.5	9.7			11.7	4.8	7.2	6.2	7.7	21.8	17.3	23.3
44007	43.5N	070.1W		7.5	29.8	59.0	4.7			20.8	4.6	6.5	3.1	9.4	19.3	19.9	16.5
44008	40.5N	069.5W		1.9	27.8	56.5	13.9			29.2	25.5	9.7			6.0	7.2	22.5
44009	38.5N	074.6W		1.8	41.8	49.1	7.3			19.1	16.4	.3.2	4.1	8.2	12.3	18.5	26.4
44011	41.1N	066.6W			41.1	38.4	20.6			9.5	2.7	20.1	9.4	2.7	6.3	18.1	31.1
44012	38.8N	074.6W	7.5	9.4	33.3	53.6	3.7			8.1	11.9	2.8	4.0	41.1	11.1	10.2	8.7
4413	42.4N	070.8W	4.0	4.6	31.6	50.2	13.1	0.5		8.6	4.0	5.5	8.7	12.4	17.9	19.7	23.3
46001	56.3N	148.3W		3.0	22.7	54.2	19.4	0.8		8.9	5.0	3.0	4.9	6.6	21.9	31.2	18.6
46002	42.5N	130.3W		2.7	28.5	56.3	12.5			27.5	2.0	0.1	1.6	6.9	4.7	17.4	39.6
46003	51.7N	155.7W		1.8	13.6	56.9	27.5	0.1		13.9	2.2	3.0	3.0	12.1	24.9	16.1	24.9
46004	50.7N	135.9W		0.4	11.5	65.0	22.6	0.4		0.8	0.5	1.3	3.6	8.5	41.4	39.9	4.1
46005	46.1N	130.9W		0.3	17.3	56.1	23.8	2.5		10.4	1.1		0.3	7.9	12.9	39.9	27.5
46006	40.8N	137.6W		7.6	34.7	47.3	9.5	0.9		17.8	4.6	3.3	7.1	11.4	9.2	15.5	31.1
46010	46.2N	124.2W		12.0	44.0	40.5	2.8	0.8		10.0	3.9	18.3	5.2	18.6	15.0	12.8	16.3
46011	34.9N	120.9W		12.7	40.2	43.0	4.2			23.0	9.5	3.9	3.7	7.3	4.1	3.0	45.5
46012	37.4N	122.7W		5.8	27.2	56.9	9.9	0.1		35.7	4.0	1.3	2.7	7.8	1.7	2.4	44.4
46013	38.2N	123.3W		9.9	28.7	53.8	7.6			5.5	1.5	4.1	2.8	2.6	4.6	4.3	74.5
46014	39.2N	124.0W		6.6	28.8	46.3	18.1	0.2		33.7	3.6	3.7	3.5	18.0	3.5	1.1	48.8
46016	63.3N	170.3W	0.5	3.8	24.9	45.9	24.9	0.5		22.5	34.6	7.2	10.4	8.5	6.7	3.0	7.2
46017	60.3N	172.3W	0.5	1.4	18.0	46.8	32.4	1.4		33.1	34.8	1.6	8.3	9.2	7.4	2.9	2.6
46018	60.3N	177.0W		1.4	7.2	51.2	36.8	3.3		9.7	38.9	7.2	11.5	7.9	10.5	5.7	8.6
46022	40.8N	124.5W		8.5	24.8	57.5	9.1			63.8	5.8	1.4	3.5	12.8	4.0	3.2	5.6
46023	34.3N	120.7W		6.8	31.7	49.0	12.5			18.8	2.4	0.9	8.2	2.4	3.3	2.0	62.0
46024	32.8N	119.5W		8.3	50.2	37.3	4.3			12.0	6.5	0.8	1.8	3.7	9.1	13.2	54.8
46025	33.6N	119.0W		27.0	54.6	17.6	0.8			7.3	8.0	5.6	6.8	5.2	10.9	28.7	27.4
46026	37.8N	122.7W		15.5	28.4	46.1	10.0			4.3	2.0	2.3	2.4	6.3	2.3	23.3	57.2
46028	35.8N	121.9W			4.5	77.3	18.2									9.1	90.9
46029	46.2N	124.2W		12.7	48.7	36.0	2.7			10.4	4.5	17.6	4.7	22.3	11.9	12.7	13.9
46030	40.4N	124.5W	4.6	4.8	33.3	51.4	10.6			57.0	4.9	1.7	13.4	10.6	1.6	3.4	7.4
46031	55.5N	161.7W		4.5	25.9	54.6	14.7	0.4		19.0	1.2		3.5	13.4	5.7	3.5	53.8
46032	54.2N	165.8W			28.0	41.5	28.0	2.6		24.6	17.5	5.7	8.5	12.8	13.1	6.5	11.3
46033	55.8N	159.8W			33.3	53.3	13.3			13.3	13.3				8.3	15.0	50.0
46034	58.1N	167.1W			20.8	47.9	31.3			2.1	4.2	11.5	22.4	22.9	12.0	13.0	12.0
51001	23.4N	162.3W		2.8	26.3	47.5	5.4			7.8	33.5	30.7	5.6	9.3	3.2	9.1	5.7
51002	17.2N	157.8W		0.9	20.3	78.6	0.1			3.9	13.6	72.1	10.9				0.2
51003	19.2N	160.6W		0.7	15.6	52.6				2.6	25.4	38.5	25.1	5.8	1.5	0.5	0.6
51004	17.5N	152.5W		1.3	17.8	80.4	0.4			1.3	25.9	59.1	10.6	2.1	0.3		0.6
ALRF1	25.0N	080.4W	1.0	2.5	19.7	59.1	18.7			9.2	16.5	26.8	16.8	4.6	2.3	5.5	4.4
ALSN6	40.5N	073.8W	0.3	1.9	17.8	56.3	18.0	5.9		14.9	14.9	6.5	4.1	2.2	16.9	15.1	22.4
BURL1	28.9W	088.4W	1.8	5.5	23.1	62.6	6.3	0.5		26.1	14.6	21.2	5.7	6.2	3.8	12.1	10.3
CAPV1	43.4N	124.7W	3.7	9.1	32.2	38.0	10.6			29.9	19.9	9.9	3.3	15.2	10.6	5.1	9.1
CHLV2	36.9W	075.7W	2.0	7.8	29.3	44.9	19.4	1.5		19.5	11.3	6.2	4.2	12.1	17.7	7.9	21.6
CLKN7	29.7N	079.9W	3.8	11.3	41.1	41.9	5.3	0.5		22.1	15.9	3.0	5.0	7.8	24.8	13.0	11.1
CSBF1	29.7N	085.4W	4.5	28.3	60.3	10.0	1.4			13.5	14.0	30.3	12.5	9.4	2.0	8.7	9.7
DBLN6	42.5N	079.4W	1.8	9.3	35.5	39.4	15.2	0.7		2.2	9.1	2.1	2.0	10.1	48.5	21.1	4.9
DESW1	47.7N	124.5W	1.9	14.7	42.4	32.4	8.7	1.8		5.3	9.5	4.9	11.1	13.0	9.0	9.2	16.0
DTSW1	47.1N	090.7W	2.5	14.0	39.5	34.0	9.0			9.3	10.1	11.7	3.9	14.7	28.7	14.8	9.9
DSLY1	55.2N	075.3W	1.6	5.0	16.7	48.1	26.7	2.7	0.6	24.7	6.3	0.7	3.4	6.4	19.4	19.0	20.0
FRIS1	32.7N	079.9W	1.1	18.5	57.0	24.3	0.2			7.9	20.4	11.6	3.3	4.4	24.1	18.1	10.2
FFIA2	57.3N	133.6W	3.8	8.0	19.5	48.7	19.7	3.9	0.2	24.8	7.9	6.9	13.9	20.9	1.4	1.0	3.2
FPSN7	33.5N	077.6W	0.2	2.8	22.4	50.8	20.4	3.4	0.2	16.3	13.2	2.0	9.3	9.5	17.6	19.3	12.7
GRIL1	29.3N	094.8W	1.2	8.1	36.2	51.3	3.4			13.7	29.5	7.2	6.8	4.7	3.5	3.0	12.1
GLLN6	43.9N	076.4W	1.8	8.8	33.3	37.9	18.9	1.1		7.5	19.8	7.4	5.2	16.1	17.9	19.0	12.1
IOSN1	43.0N	070.6W	1.4	5.5	20.6	41.5	19.6	2.7	0.2	11.4	3.2	4.7	5.3	12.6	20.8	22.3	19.5
LKWF1	26.6N	080.0W	1.1	8.9	40.5	49.5	1.1			5.4	12.3	19.5	19.2	16.7	4.6	5.1	15.3
MDRM1	44.0N	068.1W	1.8	2.5	16.3	48.9	28.5	3.5	0.3	10.8	5.6	8.8	7.2	10.0	13.9	13.0	30.7
MISM1	43.8N	068.9W		3.3	15.5	47.6	29.6	3.3	0.9	9.8	4.3	9.4	7.3	9.2	16.3	16.7	25.0
NWPO3	44.6N	124.1W	4.4	42.2	28.9	24.7	2.2			31.1	38.9	25.6					4.4
PTLM1	48.2N	088.9W			12.5	56.3									6.3	75.0	18.8
PTAC1	39.0N	123.7W	5.9	15.6	40.7	40.1	3.6			49.4	14.6	9.9	3.9	16.4	1.9	0.7	3.2
PTAT2	27.8N	097.1W	1.8	7.0	42.1	45.7	5.1			24.7	20.2	20.2	13.9	3.4	0.7	1.7	15.1
PTGC1	34.6N	120.7W	5.3	8.9	19.8	36.4	12.7	2.3		48.5	5.8	0.9	4.9	17.7	0.6	1.4	20.5
SRIO1	41.7N	082.8W	6.7	4.2	35.2	49.8	10.8			5.9	1.1	8.5	4.5	14.7	31.9	21.4	12.1
SGNW3	43.8N	087.7W	1.4	6.5	35.3	52.1	4.1			11.7	2.7	10.9	9.2	12.0	17.7	23.8	24.0
STSW1	48.3N	122.7W	5.2	16.6	49.2	27.2	0.1	0.9		3.6	2.5	12.0	32.4	16.4	7.2	15.4	6.5
SJLF1	30.4N	081.4W	1.5	10.6	61.0	27.2	1.2			13.7	17.0	8.0	8.8	17.6	9.2	14.8	10.9
SPST2	29.7N	094.1W	2.4	11.1	47.4	41.2	0.3			17.4	21.6	15.6	71.4	6.5	5.3	1.5	10.7
STDM1	47.2N	087.2W	2.0	6.3	23.3	40.1	25.5	5.0		15.1	12.1	4.8	5.1	16.5	7.5	16.7	22.1
TTIW1	48.4N	124.7W	3.9	8.3	35.8	42.8	12.1	1.0		0.6	5.9	25.8	10.4	21.2	17.9	13.7	5.0
WPOW1	47.7N	122.4W	7.4	34.4	47.3	10.4	2.0			10.1	11.0	8.9	26.2	35.4	7.2	0.3	1.0

FEBRUARY 1985 | WAVE HEIGHTS (METERS) | FREQUENCY OF WAVE HEIGHTS (%)

BUOY	LAT	LONG	OPS	MAX	DY	HR	MEAN	<1M	1-1.5M	2-2.5M	3-3.5M	4-5.5M	6-7.5M	8-9.5M	>9.5M
41002	32.3N	075.3W	049	2.5	27	21	1.7		61.2	38.7					
41006	29.3N	077.3W	670	4.0	12	18	1.4	0.4	46.4	39.4	9.2	4.1	0.2		
42001	25.9N	089.7W	668	5.5	12	02	1.5	15.4	50.4	25.1	6.2	2.6			
42002	26.0N	093.5W	667	5.5	11	23	1.5	15.5	44.2	33.4	6.4	2.2			
42003	26.0N	085.9W	670	5.0	12	17	1.7	10.4	40.1	42.2	7.2	1.9			
42007	30.1N	088.9W	487	1.5	11	19	1.8	46.6	53.3						
44004	38.5N	070.7W	634	9.0	12	23	2.4		38.4	36.1	11.6	9.9	2.9	0.7	
44005	42.7N	068.4W	655	7.0	13	12	2.2	4.4	30.0	37.2	20.0	7.6	0.6		
44007	43.5N	070.1W	549	6.5	13	10	1.2	37.3	46.4	8.9	2.7	3.0	1.4		
44008	40.5N	069.5W	117	4.0	28	05	1.9		42.7	47.8	7.6	1.7			
44011	41.1N	066.6W	656	6.0	28	10	2.6		39.2	25.0	12.5	21.4	1.7		
46001	56.3N	148.3W	667	11.5	27	17	3.4		3.7	31.9	35.8	22.0	4.0	2.0	0.2
46002	42.5N	130.3W	671	6.5	11	09	2.9		1.7	52.4	27.4	17.7	0.5		
46003	51.7N	155.7W	669	8.5	27	08	3.6			17.0	40.3	39.0	3.1	0.4	
46004	50.7N	135.9W	657	11.5	15	01	4.0		1.7	16.8	24.7	47.0	6.7	2.1	0.6
46006	40.8N	137.6W	669	6.0	14	20	2.4		34.2	39.1	18.3	14.9	1.3		
46010	46.2N	124.2W	634	8.0	11	11	2.5		17.5	49.2	22.3	9.6	0.7	0.4	
46011	34.9N	120.9W	670	5.0	21	03	2.0	0.1	40.4	42.3	13.1	3.8			
46012	37.4N	122.7W	665	4.5	20	12	2.0	1.3	38.1	46.4	11.5	3.3			
46013	38.2N	123.3W	663	4.5	16	12	2.3		23.2	44.1	29.4	3.1			
46014	39.2N	124.0W	665	4.5	16	09	2.4	1.2	18.7	42.8	32.3	4.8			
46022	40.8N	124.5W	670	5.0	02	13	2.8	0.1	8.5	37.9	41.6	11.7			
46023	34.3N	120.7W	670	5.5	21	00	2.1		31.9	48.3	14.6	5.0			
46024	32.8N	119.5W	669	4.5	21	01	1.9		48.1	37.8	10.9	3.1			
46025	33.6N	119.0W	669	2.5	09	22	1.0	29.7	71.7	7.4					
46026	37.8N	122.7W	314	3.0	16	15	1.8		42.0	57.6	0.3				
46029	46.2N	124.2W	669	8.0	11	17	2.5		19.7	47.0	21.8	10.4	1.1	0.4	
51001	23.4N	162.3W	667	4.5	14	05	2.6		3.1	61.1	29.9	5.7			
51002	17.2N	157.8W	663	4.0	01	00	2.3		9.9	77.8	12.0	0.1			
51003	19.2N	160.6W	667	3.5	01	00	2.3		5.6	80.0	14.2				
51004	17.5N	152.5W	364	3.5	15	11	2.6		1.6	62.9	35.4				
CHLV2	36.9N	075.7W	649	3.5	12	14	1.0	33.2	59.1	8.2	1.3				

MARCH 1985			AIR TEMPERATURE (DEG C)							SEA TEMPERATURE (DEG C)							AIR-SEA TEMPERATURE DIFFERENCE (DEG C)						
BUOY	LAT	LONG	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN
41001	34.9N	072.9W								076	04	18.6	31 20	17.1	29 06	17.5							
41002	32.3N	075.3W								741	31	24.3	20 20	19.0	03 13	22.7							
41006	29.3N	077.3W								742	31	25.0	14 22	21.9	26 09	23.4							
42001	25.9N	089.7W								742	31	26.3	15 20	22.6	02 12	23.6							
42003	26.0N	085.9W								741	31	27.1	12 20	24.5	19 06	25.5							
42007	30.1N	088.9W								736	31	23.0	14 22	15.6	01 04	18.5							
44004	38.5N	070.7W								732	31	16.1	31 09	12.5	01 00	13.7							
44005	42.7N	068.4W								741	31	06.7	11 17	05.0	26 06	05.7							
44007	43.5N	070.1W								692	31	03.7	29 19	01.4	27 07	02.4							
44008	40.5N	069.5W								658	31	07.3	11 18	04.4	04 20	05.3							
44009	38.5N	074.6W								712	31	08.5	30 00	04.3	01 03	06.0							
44011	41.1N	066.6W								740	31	05.9	10 20	04.0	07 22	04.7							
44012	38.8N	074.6W								727	31	07.3	29 21	04.4	01 15	05.7							
44013	42.4N	070.8W								739	31	05.4	28 21	02.8	01 05	03.6							
46001	56.3N	148.3W								740	31	05.0	30 01	04.4	25 11	04.6							
46002	42.5N	130.3W								725	31	10.6	18 22	09.7	09 10	09.9							
46003	51.7N	155.7W								739	31	04.3	01 23	03.7	24 12	04.0							
46004	50.7N	135.9W								741	31	06.9	10 01	03.5	24 10	06.5							
46005	46.3N	130.9W								738	31	09.6	17 23	08.4	07 16	08.7							
46006	40.8N	137.6W								743	31	13.3	01 01	12.2	24 14	12.7							
46010	46.2N	124.2W								711	31	09.4	18 00	06.3	01 10	08.2							
46011	34.9N	120.9W								742	31	14.2	10 00	10.3	26 15	11.9							
46012	37.4N	122.7W								739	31	12.2	01 03	10.3	28 08	11.1							
46013	38.2N	123.3W								733	31	11.0	14 23	09.7	31 10	09.7							
46014	39.2N	124.0W								738	31	10.6	13 20	08.7	03 14	09.8							
46022	40.8N	124.5W								736	31	11.2	30 22	07.9	08 11	09.1							
46023	34.3N	120.7W								736	31	14.9	17 22	10.5	24 14	12.3							
46024	32.8N	119.5W								740	31	16.7	31 22	12.6	30 12	13.7							
46025	33.6N	119.0W								738	31	15.6	23 23	12.9	06 15	13.8							
46026	37.8N	122.7W								738	31	12.3	09 23	09.5	30 13	10.8							
46029	46.2N	124.2W								740	31	09.1	15 23	06.2	01 08	08.0							
46030	40.4N	124.5W								735	31	10.8	30 23	07.4	06 06	09.1							
46032	54.2N	165.8W								218	31	03.8	02 01	02.6	24 13	03.1							
46033	55.8N	159.8W								242	31	02.8	09 04	01.7	20 19	02.1							
46034	55.1N	163.1W								244	31	02.9	04 01	02.1	26 16	02.5							
51001	23.4N	162.3W								741	31	24.3	01 13	22.0	14 00	23.1							
51002	17.2N	157.8W								741	31	24.7	01 23	23.7	28 14	24.2							
51003	19.2N	160.8W								742	31	24.9	02 02	24.0	24 10	24.4							
51004	17.5N	152.5W								741	31	24.3	31 23	22.8	20 15	23.2							
ALRF1	25.0N	080.6W								738	31	26.0	15 19	21.8	20 16	24.1							
CHLV2	36.9N	075.7W								725	31	12.1	29 19	04.8	01 11	07.2							
DSLN7	35.2N	075.3W								734	31	21.5	13 19	08.3	27 08	17.8							
FPSN7	33.5N	077.6W								273	12	19.6	26 22	15.1	25 09	17.8							
GDIL1	29.3N	090.0W								734	31	24.1	14 20	16.5	19 12	20.1							
LKWF1	26.6N	080.0W								739	31	25.2	14 00	22.0	19 05	23.4							

MARCH 1985			PRESSURE (MB)							WIND SPEEDS (KNOTS)				MEAN WIND SPEED (KNOTS)								
BUOY	LAT	LONG	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN	OBS	MAX	DY HR	DIR	N	NE	E	SE	S	SW	W	NW	TOTAL
41001	34.9N	072.9W	076	04	1017.5	31 14	1012.2	30 20	1014.6													
41002	32.3N	075.3W	741	31	1035.4	07 15	1002.3	17 21	1020.3	737	35	18 13	330	15.3	16.3	14.2	15.9	13.4	16.0	13.4	17.1	15.3
41006	29.3N	077.3W	742	31	1031.1	27 16	1004.3	17 18	1020.2	737	33	17 17	230	12.2	13.1	10.7	12.5	10.9	11.6	11.4	15.7	12.2
42001	25.9N	089.7W								742	27	20 05	120	16.3	13.1	11.7	15.6	13.4	9.1	10.6	12.9	13.6
42002	26.0N	093.5W	740	31	1026.3	09 15	1006.7	20 23	1017.8	740	33	31 11	010	18.8	15.3	14.6	16.8	16.4	9.3	10.4	14.1	15.7
42003	26.0N	085.9W	741	31	1025.8	08 16	1007.5	21 09	1018.4	735	35	21 06	140	14.9	13.1	14.7	15.8	16.1	15.8	11.5	11.8	14.7
42007	30.1N	088.9W	736	31	1028.3	06 17	1003.9	21 11	1018.6	720	32	21 06	070	10.8	13.3	12.0	10.8	9.0	8.1	8.9	8.5	10.4
44004	38.5N	070.7W	731	31	1040.9	07 16	996.4	12 21	1017.2	732	41	12 18	190	20.5	18.8	20.1	15.5	21.1	19.8	18.9	20.1	19.6
44005	42.7N	068.4W	741	31	1042.3	07 15	992.3	13 03	1015.2	732	28	12 18	150	13.8	6.4	7.8	14.8	11.7	13.8	14.6	15.5	14.1
44007	43.5N	070.1W	690	31	1042.4	07 14	988.0	12 21	1014.9	692	28	12 15	120	13.0	9.7	9.2	11.2	11.6	13.7	12.3	13.4	12.6
44008	40.5N	069.5W	658	31	1041.2	07 15	992.9	12 20	1015.5	616	37	12 19	180	15.5	12.3	9.4	9.3	14.6	14.3	16.2	17.5	14.8
44009	38.5N	074.6W	720	31	1041.9	07 15	997.7	12 16	1018.8	698	31	06 05	330	16.9	15.5	12.3	12.2	14.2	11.3	13.1	16.4	14.4
44011	41.1N	066.6W	741	31	1040.2	07 15	994.1	18 04	1014.5	734	31	13 00	170	14.8	12.1	3.6	8.5	15.7	12.1	15.2	15.6	14.3
44012	38.8N	074.6W	729	31	1042.0	07 15	997.1	12 17	1018.6	717	29	12 15	180	17.8	13.7	12.9	10.5	13.5	11.3	10.9	14.5	13.4
44013	42.4N	070.8W	741	31	1042.3	07 15	988.6	12 22	1015.5	717	29	15 19	280	13.1	11.1	8.9	10.9	10.7	12.4	15.5	16.0	13.3
46001	56.3N	148.3W	741	31	1032.6	04 12	977.4	15 05	1002.8	736	34	03 20	300	12.1	12.1	15.1	16.2	15.8	18.2	16.4	20.7	16.7
46002	42.5N	130.3W	725	31	1034.1	02 18	995.0	26 15	1019.4	723	32	26 20	290	14.6	13.0	18.9	18.6	13.0	15.5	17.8	16.1	16.1
46003	51.7N	155.7W	740	31	1046.7	03 22	976.3	17 04	1007.6	735	47	10 00	190	12.1	5.9	15.8	17.2	21.0	22.9	22.4	23.7	21.5
46004	50.7N	135.9W	741	31	1039.4	01 20	988.0	26 14	1013.0	737	36	04 00	300	13.7	10.8	9.7	13.9	16.4	13.7	13.8	17.6	14.7
46005	46.3N	130.9W	738	31	1036.6	01 19	987.9	23 11	1018.0	731	52	23 11	240	17.4	18.3	17.9	12.3	16.4	16.8	19.6	21.4	18.6
46006	40.8N	137.6W	743	31	1042.0	02 07	1000.1	08 15	1023.6	743	41	08 17	010	20.0	15.9	5.3	2.7	13.3	19.2	18.6	22.5	19.7
46010	46.2N	124.2W	718	31	1028.8	12 20	987.9	27 02	1017.6	707	31	23 16	180	9.0	6.8	9.7	12.1	14.6	11.8	12.0	11.1	11.6
46011	34.9N	120.9W	742	31	1028.6	30 18	1013.5	02 23	1019.9	717	30	02 16	300	10.0	3.5	3.6	6.4	10.7	8.8	7.1	15.8	12.9
46012	37.4N	122.7W	739	31	1029.3	30 16	1009.2	27 03	1019.5	739	37	02 06	320	17.0	7.4	4.8	12.3	12.2	11.6	10.2	17.0	14.6
46013	38.2N	123.3W	736	31	1029.3	30 19	1005.4	27 01	1018.8	731	31	02 05	320	6.6	7.0	7.9	8.8	8.2	9.2	7.7	16.3	13.1
46014	39.2N	124.0W	738	31	1032.6	30 18	1004.1	26 22	1020.3	732	39	02 04	340	16.0	3.6	6.0	12.1	11.4	11.0	9.8	15.8	13.6
46016	63.3N	170.3W	245	31	1028.6	27 09	980.6	08 09	1005.9	244	48	18 12	040	14.2	22.5	12.0	15.3	17.0	13.6	17.6	16.6	18.8
46017	60.3N	172.3W	246	31	1031.5	27 10	971.4	08 07	1004.7	245	36	07 22	110	16.9	14.9	15.9	19.8	15.4	15.6	15.7	8.0	14.8
46018	60.3N	177.0W								112	37	08 10	020	22.5	24.8	28.5	19.1	19.8	22.0	26.4	15.7	23.5
46022	40.8N	124.5W	736	31	1033.2	30 19	999.9	26 19	1020.0	723	31	02 01	350	12.9	6.2	4.5	8.1	14.7	9.5	8.9	9.6	11.1
46023	34.3N	120.7W	736	31	1027.4	30 19	1013.2	03 02	1019.4	735	33	02 17	310	13.9		4.0	7.8	7.7	9.1	8.0	17.5	15.3
46024	32.8N	119.5W	740	31	1026.1	30 19	1013.7	26 00	1018.7	737	29	29 04	330	7.1	4.2	1.0		6.1	8.9	9.6	14.6	12.9
46025	33.6N	119.0W	738	31	1025.5	30 18	1011.4	03 03	1017.6	713	28	02 22	300	4.9	4.1	3.1	2.7	3.4	6.9	9.1	9.7	08.3
46026	37.8N	122.7W	738	31	1029.4	30 18	1007.1	27 02	1018.9	725	33	02 04	300	2.8	10.7	8.9	11.3	11.0	10.4	11.1	16.8	13.1
46029	46.2N	124.2W	740	31	1028.7	12 20	988.0	27 02	1017.4	731	29	23 15	170	8.9	6.1	9.1	13.5	13.8	11.0	11.6	10.2	11.0
46030	40.4N	124.5W	736	31	1032.3	30 19	1000.9	26 21	1019.7	610	35	26 14	140	14.4	4.7	6.1	13.9	10.7	7.9	9.4	11.8	12.2
46031	55.5N	161.7W	244	31	1040.5	03 22	962.7	17 16	1003.6	246	40	01 04	170	18.3	11.6	8.3	12.6	17.9	14.4	9.9	19.6	16.0
46032	54.2N	165.8W	218	31	1041.8	03 22	967.7	17 16	1005.8	218	35	22 22	330	20.8	15.7	22.5	17.4	15.1	13.0	16.4	23.2	18.4
46033	55.8N	159.8W	242	31	1037.0	04 01	967.9	17 22	1001.5	242	42	10 10	310	12.7	10.2	20.0	14.9	14.1	19.7	13.1	22.3	16.7
46034	55.1N	163.1W	244	31	1043.7	03 22	966.2	17 16	1007.3	244	42	01 04	160	20.8	19.0	23.4	23.6	17.2	15.9	18.7	22.6	20.2
51001	23.4N	162.3W	741	31	1025.9	20 20	1010.5	01 15	1020.2	741	30	07 13	060	9.4	18.2	17.3	16.8	5.0	5.0	5.0		17.6
51002	17.2N	157.8W	742	31	1020.7	20 10	1008.6	01 03	1015.1	055	26	02 20	080			20.7	16.9					19.8
51003	19.2N	160.8W	742	31	1022.8	20 20	1008.9	01 15	1016.9	742	26	07 10	060		17.2	15.3	15.1	13.0				15.9
51004	17.5N	152.5W	741	31	1020.8	20 08	1008.0	05 14	1014.8	741	29	07 16	040		18.7	17.3	14.8					18.1
ALRF1	25.0N	080.6W	736	31	1027.3	27 15	1009.3	22 01	1019.2	718	32	18 11	340	13.3	15.5	13.1	12.2	8.8	11.2	8.7	10.1	12.8
ALSN6	40.5N	073.8W	739	31	1042.7	07 14	994.0	12 16	1018.0	690	40	13 02	300	19.1	14.1	14.1	19.4	11.3	17.7	13.0	16.9	16.3
BURL1	28.9N	089.4W	738	31	1028.0	06 15	1004.9	21 05	1019.0	701	28	21 03	160	12.3	7.5	13.0	13.2	9.2	9.7	9.8	10.7	11.2
CARO3	43.4N	124.7W	737	31	1031.4	31 19	992.2	26 20	1019.5	659	33	26 15	200	14.2	7.8	3.5	5.5	13.3	14.3	16.3	8.2	11.9
CHLV2	36.9N	075.7W	728	31	1041.0	07 14	1000.4	12 17	1019.4	687	32	05 08	200	15.2	15.9	11.2	9.8	18.1	17.2	15.9	14.1	15.3
CLKN7	34.7N	079.9W	737	31	1038.0	07 14	1005.0	17 20	1019.8	699	29	21 21	030	11.4	14.7	15.4	11.0	10.3	12.4	8.0	8.8	12.0
CSBF1	29.7N	085.4W	734	31	1030.3	26 16	1007.4	21 21	1019.8	710	16	21 13	100	4.2	4.1	7.2	5.6	5.3	4.0	8.2	4.0	05.7
DBLN6	42.5N	079.4W	511	25	1041.4	06 17	987.9	12 16	1019.6	502	43	12 16	220	6.1	11.3	7.8	8.7	6.1	12.9	13.9	8.5	10.7
DESW1	47.7N	124.5W	735	31	1028.1	12 19	987.5	27 05	1016.9	722	41	23 15	170	7.5	5.3	5.8	19.2	15.6	11.9	7.9	10.7	12.6
DISW3	47.1N	090.7W	737	31	1036.3	06 08	994.6	27 09	1017.1	715	51	04 13	050	18.1	20.3	8.6	5.9	6.7	12.3	11.6	13.4	13.9
DSLN7	35.2N	075.3W	612	27	1037.0	07 14	1003.2	12 21	1019.5	699	45	22 22	110	19.4	14.0	22.2	19.8	23.6	24.7	14.8	15.3	19.6
FBIS1	32.7N	079.9W	738	31	1036.7	07 14	1008.2	17 21	1020.3	706	22	06 15	060	7.0	11.5	9.9	5.0	6.7	8.4	5.1	4.9	08.1
FFIA2	57.3N	133.6W	734	31	1033.2	01 21	992.8	24 02	1010.6	695	39	05 22	350	18.9	5.5	5.8	17.2	12.4	7.8	7.0	12.2	14.9
FPSN7	33.5N	077.6W	737	31	1035.4	07 16	1003.9	17 09	1019.0	698	37	18 08	350	15.4	17.0	16.9	16.8	17.8	18.0	11.6	11.8	16.1
GDIL1	29.3N	090.0W	713	31	1028.0	09 16	1004.9	20 23	1018.5	716	25	20 23	120	10.5	13.7	9.7	8.6	7.8	7.3	9.2	12.0	09.5
GLLN6	43.9N	076.4W	733	31	1039.1	07 02	987.4	12 12	1016.9	710	32	05 21	260	8.8	10.8	8.8	14.3	14.7	12.0	16.1	12.3	13.1
IOSN3	43.0N	070.6W	739	31	1041.8	07 13	987.8	12 22	1014.6	714	35	12 14	130	14.2	11.8	13.0	14.0	13.9	15.6	17.6	17.2	15.6
LKWF1	26.6N	080.0W	739	31	1028.6	26 16	1008.4	17 21	1019.3	729	26	07 15	060	9.3	12.6	11.3	11.1	10.1	5.2	4.5	7.2	09.6
MDRM1	43.6N	068.1W	738	31	1041.2	07 15	988.6	13 02	1013.7	707	45	12 20	130	18.2	17.5	15.4	14.5	13.6	18.1	17.7	21.1	18.2
MISM1	43.5N	068.9W	737	31	1041.8	07 14	988.0	13 00	1014.3	707	49	12 18	120	16.8	9.3	18.0	17.9	14.1	17.8	19.3	19.3	17.8
NWPO3	44.6N	124.1W	737	31	1030.4	31 17	990.6	26 22	1018.6	701	39	23 16	190	13.1	3.0	4.8	4.8	16.0	15.0	14.8	9.9	11.1
PTAC1	39.0N	123.7W	737	31	1031.3	30 18	1004.3	26 22	1019.7	655	34	07 13	010	13.1	6.5	2.6	7.7	10.6	10.1	8.1	8.3	09.9
PTAT2	27.8N	097.5W	736	31	1026.6	09 17	1002.8	30 02	1016.5	704	26	05 12	020	14.4	10.3	10.1	13.3	10.3	5.8	10.8	10.6	11.7
PTGC1	34.6N	120.7W	726	31	1027.4	30 17	1013.1	03 01	1019.4	600	35	02 16	320	15.4	6.1	3.0	7.8	6.3	3.5	5.9	18.9	14.6
SBIO1	41.7N	082.8W	733	31	1041.0	06 17	992.4	12 06	1017.9	714	42	12 08	270	8.7	9.4	10.3	10.3	12.5	15.4	15.8	14.4	12.9
SGNW3	43.8N	087.7W	732	31	1036.7	06 15	989.9	21 22	1016.5	713	40	04 03	090	13.6	15.8	19.6	10.9	12.9	12.0	12.2	12.3	13.6
SISW1	48.3N	122.9W	732	31	1028.4	12 18	988.7	27 05	1017.0	723	40	22 12	150	6.0	2.7	6.6	17.8	11.7	5.9	8.2	7.8	10.9
SJLF1	30.4N	081.4W	736	31	1032.7	27 16	1007.3	22 21	1019.9	712	23	07 00	050	7.7	11.3	8.0	8.5	8.9	6.8	7.9	6.9	08.4
SRST2	29.7N	094.1W	738	31	1028.4	06 16	1004.3	20 23	1018.1	715	27	20 13	130	10.0	10.0	8.6	12.7	11.4	8.1	8.1	8.3	10.8
STDM4	47.2N	087.2W								694	51	04 15	100	17.6	17.0	22.6	20.1	19.6	13.4	16.7	14.1	18.2
TTIW1	48.4N	124.7W	739	31	1026.7	12 20	987.7	27 06	1017.2	735	46	23 15	200	5.9	9.4	12.0	12.4	13.9	12.1	9.9	7.6	11.3
WPOW1	47.7N	122.4W	655	31	1026.4	12 18	989.1	27 04	1017.2	622	26	21 03	170	8.5	4.3	3.1	6.1	12.6	9.2	2.8	2.4	09.2

MARCH 1985

			TOTAL FREQUENCY OF WIND SPEEDS (%)							TOTAL FREQUENCY OF WIND DIRECTIONS (%)							
BUOY	LAT	LONG	CALM	<4KT	4-10KT	11-21KT	22-33KT	34-47KT	>47KT	N	NE	E	SE	S	SW	W	NW
41002	32.3N	075.3W		3.0	18.9	63.5	14.4	0.3		10.1	9.6	11.1	11.8	10.0	26.6	11.2	9.6
41006	29.3N	077.3W		4.6	35.3	53.7	6.4			6.6	8.2	11.4	12.2	11.2	24.5	13.2	12.7
42001	25.9N	089.7W		1.8	33.8	54.3	10.1			5.9	22.7	20.2	21.4	8.5	4.0	4.0	3.4
42002	26.0N	093.5W		0.8	21.4	61.2	16.6			7.4	9.8	22.0	37.4	13.9	4.3	2.3	3.0
42003	26.0N	085.9W		1.6	30.2	52.2	15.4	0.5		5.5	19.7	24.8	34.3	6.3	3.7	2.7	3.1
42007	30.1N	088.9W		7.1	43.5	47.9	1.5			7.0	12.3	14.8	25.5	17.0	11.7	6.5	5.2
44004	38.5N	070.7W		1.6	11.2	44.4	39.1	3.7		17.0	10.3	6.3	4.9	7.2	10.5	19.9	23.9
44005	42.7N	068.4W		4.9	23.5	61.9	9.7			18.6	1.9	0.8	3.4	9.0	21.8	19.4	25.6
44007	43.5N	070.1W		4.8	28.2	64.2	2.8			17.2	3.4	2.7	4.4	14.0	19.1	16.7	22.6
44008	40.5N	069.5W	1.3	4.2	24.8	55.8	14.4	0.6		12.5	11.0	4.4	5.4	9.2	15.1	23.3	19.2
44009	38.5N	074.6W	1.1	1.1	31.7	53.4	13.8			11.3	13.6	5.8	5.7	22.3	12.2	10.5	18.5
44011	41.1N	066.6W		7.2	21.1	56.7	15.0			20.7	7.3	1.4	2.5	9.8	12.7	21.4	24.1
44012	38.8N	074.6W	2.0	2.6	32.2	57.0	6.1			12.1	12.1	9.8	5.2	26.7	8.2	13.2	12.7
44013	42.4N	070.8W	2.0	4.2	29.8	60.3	5.7			9.8	5.8	5.4	9.8	9.4	17.8	19.1	22.9
44011	56.3N	148.3W		3.5	17.5	51.5	27.3	0.1		2.7	5.9	12.0	8.4	15.0	22.2	20.3	13.4
46002	42.5N	130.3W		2.1	18.5	58.9	20.5			16.8	3.1	5.4	4.9	4.6	16.4	20.2	28.7
46003	51.7N	155.7W		2.4	7.5	37.1	48.3	4.6		3.7	1.2	3.4	6.8	6.9	20.0	33.9	16.1
46004	50.7N	135.9W		2.6	21.2	63.2	12.5	0.5		9.7	2.4	1.3	1.9	13.4	25.4	27.5	18.4
46005	46.1N	130.9W		2.1	13.5	50.5	29.4	4.2	0.3	12.8	4.1	2.8	3.7	10.1	17.8	23.4	25.2
46006	40.8N	137.5W		1.9	13.3	56.9	26.3	1.6		20.9	9.9	0.6	0.4	2.3	23.5	11.8	30.6
46010	46.2N	124.2W		6.5	36.8	53.9	2.8			13.8	5.6	8.1	5.9	25.1	15.7	9.4	21.3
46011	34.9N	120.9W		7.1	29.4	53.3	10.2			15.0	1.8	1.4	3.3	5.6	8.3	5.2	59.4
46012	37.4N	122.7W		4.5	27.5	52.1	14.6	1.4		15.6	1.2	1.7	11.4	10.8	6.8	9.3	43.2
46013	38.2N	123.3W		6.8	34.6	44.9	13.7			0.9	0.9	4.3	10.3	7.3	6.0	10.6	59.6
46014	39.2N	124.0W		8.3	27.5	50.1	12.0	2.0		19.0	2.4	4.3	13.1	11.6	3.7	6.8	40.2
46016	63.3N	170.3W	0.8	6.6	19.3	58.1	14.6	1.2	1.2	13.6	54.1	10.8	4.0	3.5	6.7	5.9	1.4
46017	60.3N	172.3W		6.1	34.3	36.3	22.9	0.4		35.7	11.6	6.1	2.1	7.2	10.7	9.5	16.9
46018	60.3N	177.0W		0.9	7.1	39.3	30.4	22.3		15.6	16.7	12.5	6.5	8.3	12.7	20.5	7.1
46022	40.8N	124.5W		7.5	42.5	43.0	7.1			39.9	4.1	3.9	9.9	14.2	7.6	6.8	13.4
46023	34.3N	120.7W		2.9	28.2	45.7	23.3			8.1		0.4	0.7	2.8	6.1	10.4	71.6
46024	32.8N	119.5W		2.3	38.7	46.3	12.8			3.4	0.4	0.1		0.6	4.5	21.3	69.7
46025	33.6N	119.0W		18.2	55.5	21.7	4.5			8.1	1.9	2.8	1.9	3.5	10.4	16.8	28.9
46026	37.8N	122.7W		5.4	31.3	53.8	9.5			1.4	2.6	3.6	7.6	10.1	9.4	24.2	41.1
46029	46.2N	124.2W		6.8	44.0	46.4	2.7			15.1	6.8	7.6	8.8	26.1	13.1	3.3	19.3
46030	40.4N	124.5W	3.0	5.9	43.1	42.3	5.5	0.2		35.5	7.4	1.5	23.7	9.1	5.0	5.7	12.1
46031	55.5N	161.7W	0.4	6.1	22.4	43.9	25.2	2.4		30.1	13.8	3.6	3.9	20.3	8.7	6.9	12.7
46032	54.2N	165.8W			17.9	45.0	35.8	1.4		12.8	3.9	7.9	8.5	9.2	16.9	17.3	23.5
46033	55.8N	159.8W		0.8	11.8	37.6	37.3	2.5		12.2	21.1	9.2	6.3	9.3	14.4	7.7	31.7
46034	55.1N	163.1W			12.7	43.4	41.0	2.9		15.0	11.3	3.9	10.5	9.9	8.2	19.8	21.5
51001	23.4N	162.3W			4.9	72.5	22.7			0.4	49.5	45.7	4.1	0.1	<.05	0.1	
51002	17.2N	157.8W				58.2	41.8					74.8	23.2				
51003	19.2N	160.8W			6.2	90.6	3.2				32.2	58.1	9.5	0.2			
51004	17.5N	152.5W			7.2	74.6	18.2				55.4	44.5	0.1				
ALRF1	25.0N	080.6W	1.0	7.2	32.9	47.6	12.3			5.5	16.3	45.5	15.4	2.6	4.4	4.8	5.4
ALSN6	40.5N	073.8W	0.9	3.3	17.8	56.5	20.3	2.0		15.1	8.8	11.0	4.6	5.4	17.7	12.9	26.6
BURL1	28.9N	089.4W	3.0	11.4	34.7	50.4	3.6			12.3	12.0	19.7	21.0	9.8	10.1	6.3	8.8
CAR03	43.4N	124.7W	2.0	11.7	33.8	44.6	9.9			21.7	7.8	3.8	13.0	28.5	17.2	6.0	2.0
CHLV2	36.9N	075.7W	0.7	2.9	25.8	50.4	21.0			15.8	16.6	5.3	6.1	13.6	18.0	7.9	14.6
CLKN7	34.7N	077.0W	1.6	5.9	33.6	55.7	4.9			14.9	20.0	6.9	8.0	8.0	31.2	7.4	3.6
CSBF1	29.7N	085.4W	7.5	26.6	63.5	9.9				4.2	9.5	16.8	18.7	18.8	10.0	13.6	8.5
DBLN6	42.5N	079.4W	1.6	9.8	44.8	39.6	4.4	1.4		3.9	23.5	4.6	3.0	12.8	28.9	13.6	9.4
DESW1	47.7N	124.5W	3.7	14.4	33.4	35.3	15.1	1.8		8.1	10.7	7.2	30.4	9.3	9.8	4.6	19.9
DISW3	47.1N	090.7W	1.7	5.7	37.9	37.6	14.1	4.2	0.4	6.3	30.7	8.8	4.7	11.0	24.0	6.5	7.9
DSLN7	35.2N	075.3W	1.3	2.0	11.4	47.6	33.8	5.2		19.8	13.2	4.6	7.2	7.0	26.0	10.7	11.5
FDTS1	32.7N	079.9W	2.1	15.9	56.4	25.5	0.3			10.8	18.2	12.2	5.1	10.8	28.1	6.9	8.0
FFIA2	57.3N	133.6W	3.5	6.9	25.2	47.9	17.3	2.7		17.6	5.6	4.7	45.4	19.7	2.2	1.0	3.7
FPSN7	33.5N	077.6W	1.1	4.0	22.2	47.0	26.4	0.4		15.6	16.3	4.2	4.4	5.4	34.9	9.8	9.3
GDIL1	29.3N	090.0W	1.3	8.1	51.3	40.2	0.4			7.1	11.7	19.5	20.8	17.9	9.5	9.1	4.5
GLLN6	43.9N	076.4W	0.8	4.9	33.1	52.0	10.0			10.6	12.3	3.8	8.0	14.9	13.8	26.4	10.3
IOSN3	43.0N	070.6W	1.7	5.5	20.3	52.0	21.4	0.8		7.7	5.2	3.5	9.6	13.5	15.5	23.4	21.6
LKWF1	26.6N	080.0W	2.1	11.5	46.2	39.4	2.9			3.1	9.4	21.1	22.9	15.5	8.7	8.3	10.7
MDRM1	43.6N	068.9W	1.8	3.0	18.7	40.2	34.9	1.4		15.1	3.0	2.8	8.1	6.4	20.5	16.8	27.4
MISM1	43.8N	068.9W		3.3	18.4	42.9	32.1	3.3	0.1	12.9	3.4	2.8	7.1	6.3	23.5	20.5	23.6
NWPO3	44.6N	124.1W	4.3	14.7	36.9	37.2	10.4	0.7		18.0	6.6	18.4	5.7	17.8	22.0	5.3	4.3
PTAC1	39.0N	123.7W	5.3	16.0	41.5	36.9	5.3	0.2		38.0	9.8	7.2	14.1	16.8	3.2	3.7	7.1
PTAT2	27.8N	097.5W	1.7	5.8	35.9	55.4	2.8			13.3	13.0	26.7	30.6	5.2	0.8	3.2	7.2
PTGC1	34.6N	120.7W	3.0	9.8	34.0	25.2	70.7	0.3		41.5	2.1	0.2	4.4	9.0	3.7	2.9	36.3
SBIO1	41.7N	082.8W	2.9	2.9	35.3	52.8	7.6	1.4		4.8	7.3	20.4	4.0	13.2	17.4	18.3	14.5
SGNW3	43.8N	087.7W	1.8	6.5	30.6	48.0	14.2	0.8		9.4	15.7	9.1	4.1	20.1	11.8	13.7	14.2
SISW1	48.3N	122.9W	5.8	19.8	36.1	31.1	12.4	0.6		5.6	2.5	5.6	29.9	11.2	8.3	23.3	13.7
SJLF1	30.4N	081.4W	1.7	10.4	41.0	28.2	0.4			14.0	17.3	8.8	9.2	13.6	13.4	14.5	9.3
SRST2	29.7N	094.1W	1.7	5.9	42.9	48.7	2.5			6.0	11.0	5.6	31.9	24.7	8.4	3.3	9.0
STDM1	47.2N	087.2W	0.9	2.2	12.7	58.9	25.6	3.7	0.9	11.9	13.5	17.1	4.3	19.5	7.3	16.0	8.5
TTIW1	48.9N	124.7W	3.3	9.9	37.0	48.3	3.4	1.4		2.2	10.2	23.9	16.8	12.2	13.6	14.4	6.7
WPOW1	47.7N	122.4W	6.6	20.1	42.9	33.4	3.4			19.7	16.3	1.3	8.0	43.3	8.5	1.6	1.1

MARCH 1985

			WAVE HEIGHTS (METERS)					FREQUENCY OF WAVE HEIGHTS (%)							
BUOY	LAT	LONG	ORS	MAX	DY	HR	MEAN	<1M	1-1.5M	2-2.5M	3-3.5M	4-5.5M	6-7.5M	8-9.5M	>9.5M
41001	34.9N	072.9W	076	4.0	29	12	2.4		18.4	53.9	23.6	3.9			
41002	32.3N	075.3W	738	4.5	18	15	1.9		46.8	39.0	11.9	2.1			
41006	29.3N	077.3W	737	4.0	07	09	1.8	4.3	49.7	32.1	12.8	0.8			
42001	25.9N	089.7W	706	3.0	20	22	1.2	35.2	40.9	22.3	1.4				
42002	26.0N	093.5W	734	3.5	31	12	1.4	15.3	56.5	26.7	1.3				
42003	26.0N	085.9W	735	4.0	21	04	1.4	36.0	46.5	13.8	2.9	0.5			
42007	30.1N	088.9W	527	3.5	21	15	0.8	57.3	37.7	3.6	1.3				
44004	38.5N	070.7W	711	6.5	12	19	2.2	5.3	33.1	28.9	23.0	7.8	1.5		
44005	42.7N	068.4W	737	5.0	12	22	2.1	5.9	36.2	31.3	20.3	6.1			
44007	43.5N	070.1W	570	4.0	12	20	1.0	43.1	40.2	10.8	1.5	0.1			
44008	40.5N	069.5W	656	5.5	12	20	1.9	8.6	45.2	28.9	10.6	6.4			
44011	41.1N	066.6W	736	6.5	13	22	2.4	4.6	24.8	35.4	21.0	13.0	0.9		
46001	56.3N	148.3W	737	10.0	10	16	3.9		4.3	19.8	25.7	35.4	13.2	1.2	0.1
46002	42.5N	130.3W	729	9.0	04	19	3.8			12.8	41.9	32.8	8.8	1.5	
46003	51.7N	155.7W	737	11.5	10	03	4.7		3.3	12.3	22.6	31.2	22.5	6.1	1.7
46004	50.7N	135.9W	737	12.0	04	04	4.1		0.9	12.6	33.3	43.5	5.5	1.8	2.0
46006	40.8N	137.5W	741	7.5	05	00	2.9		0.2	19.0	26.3	46.5	7.8		
46010	46.2N	124.2W	671	7.0	05	20	2.9	1.3	5.2	36.0	34.0	14.7	2.2		
46011	34.9N	120.9W	740	6.5	02	18	2.7	1.6	10.5	41.0	36.6	7.9	1.3		
46012	37.4N	122.7W	735	5.5	02	06	2.5		10.6	54.0	26.9	8.4			
46013	38.2N	123.3W	710	6.0	02	09	2.9		6.6	37.2	40.1	15.6	0.2		
46014	39.2N	124.0W	731	6.0	05	11	2.9		8.7	36.5	37.3	17.2	0.1		
46022	40.8N	124.5W	733	7.5	05	05	3.3		4.0	25.3	41.6	27.0	1.9		
46023	34.3N	120.7W	734	7.0	02	19	2.9	1.4	7.4	38.2	34.0	16.0	2.5		
46024	32.8N	119.5W	729	6.0	03	03	2.6	1.3	15.0	43.6	20.8	16.9	0.1		
46025	33.6N	119.0W	735	3.5	02	20	1.4	4.6	48.1	22.3	4.8				
46026	37.8N	122.7W	732	6.0	02	02	2.1	0.5	25.0	58.4	15.1	0.8			
46029	46.2N	124.2W	736	6.5	01	22	2.9	1.6	6.1	30.9	34.6	14.8	2.8		
51001	23.4N	162.1W	738	6.5	05	17	3.4			29.7	43.2	27.6	2.8		
51002	17.2N	157.8W	740	5.5	03	12	3.6			3.1	59.7	37.1			
51003	19.2N	160.8W	739	5.0	07	14	2.9			38.5	52.2	9.2			
51004	17.5N	152.5W	737	5.5	07	17	3.4			4.2	69.8	25.9			
CHLV2	36.9N	075.7W	724	2.5	12	04	1.0	36.4	57.1	6.3					
WPOW1	47.7N	122.4W	123	0.0	00	00	0.0								38.0

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